Great Hands, Great Life!

WHY PROPER HAND EXERCISE MUST BE PART OF YOUR LIFE

DR. TERRY ZACHARY

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Dedications

To Jackson, Jonah, Emily & Rhonda, my inspirers…

To Mom & Darryl, my wing-builders…

To my core buddies, my mirrors…

Thanks for giving me a Great Life;

And limitless bounds.

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1 – Background

My Interest in the Hand Muscles

I have always loved learning about the body and how it works at its best - to the point where I don't feel like I've worked a day in my life. If there is one word I can use to describe my interest in this subject, it is *love*. I highly recommend trying to do what you love for a living. I know it's not immediately realistic for everyone, but please put some thought at least the possibility.

I would like to start by pointing out that when I first pursued a career in health and sports training, I never dreamed I would end up writing a book about *hand muscles, hand exercise* OR *grip training*. It just didn't seem *very deep, interesting, or relevant*.

It wasn't that I didn't think *grip* was important. I knew that it was, and I always knew that the hand muscles and associated anatomy were an enormous challenge to try to sort out and understand. I just didn't think there was much I needed to know about using or exercising the hands. *It looked pretty basic. Grab, grab, grab. Squeeze, squeeze, squeeze.*

Growing up in the 70s and 80s, I diligently gripped tennis balls, racket balls, coiled hand strengtheners, or anything I could get my hands on. This is because as a kid—and ever since—I LOVED sports; it had always been my main passion and my happy place. Be it golf, hockey, baseball, basketball, volleyball, tennis, badminton, soccer, racquetball, squash, or table tennis, to name but a few, I played nearly all of them; and most required grip.

However, as I got older, I most specifically narrowed my love to golf, hockey, and basketball. Out of all of my sporting interests, golf required the most detailed learning to get really good. I spent as much time as possible on the course, on the driving range, and on the various practise areas. I read whatever golf books I could get my hands on. Anyone in those days that advised about grip training in

golf spoke about 'squeezing' something to gain better hand strength for improved performance. The stronger the hands were, the more the golfer could *relax* and still maintain control of the golf club. Stronger hands meant more grip strength to get the club through the tough grass of high rough areas off of the fairway. The result would be better control and more natural distance. That was the thinking in general. That was the theory, and it made a lot of sense to me.

On the other hand, hockey seemed to require more of a focus on straight-on power, strength, speed, and grit. Stronger hands, wrists, and forearms meant a heavier, quicker shot, whether a slap-shot, wrist-shot, snap-shot or backhand. Stronger hands also meant better puck control, stick handling, face-offs, puck possession, and more 1-on-1 puck battle wins. These are all facets of hockey that are still vital today, in fact, much MORE pronounced as the speed, power and skill sets of the modern game rise, while outcomes become more pronounced in game situations. As more money is at stake for professional players and organizations, any advantage extrapolates into measurable data.

Basketball was different from both golf and hockey in my mind. I always watched players whom I respected that seemed to have *Great Hands*. I watched in awe. They made the game look so easy, so beautiful, and so cool. Yes, they appeared strong, but they also appeared to receive, handle, and shoot the ball with ease and grace — fast ball movement, quick catches and then high, spinning shots. My first memory of note was watching Chris Mullin of the St. John's Redman (and later the NBA). He was pure, and he was also a lefty. I always loved watching lefties shoot a basketball. I was a righty, but I worked like a dog on my ball handling, dribbling, passing, and shooting skills. As a kid, I never related hand exercise to basketball, and as I aged and played at higher levels in high school and junior college, my opinion changed very little. Maybe I saw the need for proper exercise rehabilitation after experiencing reoccurring, nagging finger and thumb sprains and jams, but that was about it (I later realized just how much the shooting mechanics in basketball are aided by strong, balanced hand muscles and proper range of motion; more on that later in the book).

That was my exposure to hand exercise while growing up. And I never thought more about it until years later when I went to professional college.

Fast-forward to 1989, my final year at Palmer College. My golf team was about to go on a tournament trip, and I was about to miss one week of classes. As a weigh-off for being excused, my x-ray professor, Dr. Percuco gave me an assignment to prepare a report that would have me compare and contrast tennis elbow vs. golfer's elbow.

From an x-ray class point of view, it seemed like a strange task, but it turned out to be quite a significant event in my life path. Plus, it was creatively golf-related, so he likely knew it would pique my interest. I was to turn in the report upon my return. I took it quite seriously, mostly because I really enjoyed this professor and wanted to impress him. I also wanted to show people (including my golf team) that I was a dedicated student athlete. I take what I do seriously and still do to this very day. 'If it's worth doing, it's worth doing well,' my Uncle Barry once told me.

During that trip, I was able to review the anatomy of the tendon attachments at the lateral epicondyle (i.e., lateral epicondylitis = tennis elbow), as well as at the tendon attachments at the medial epicondyle (i.e., medial epicondylitis = golfer's elbow). If these terms seem like gibberish thus far, please read on. The concepts will be well explained in more detail later in the book.

What seemed like a boring report to many was fascinating to me, but I still mostly regurgitated what the diagnostic and therapeutic textbooks of the day printed relating to the two conditions. Thirty years later, most textbooks, websites, and blogs say much the same thing.The report I turned in was *well researched* and as complete as I knew *for sure*, but I certainly didn't stick my neck out or add any new ideas relating to these conditions.

What was vital in hindsight is that I remember thinking that none of the textbooks ever *related* the two conditions. No textbook mentioned an *imbalance between the front and the back of the hand, wrist, forearm, and elbow.* And no textbook mentioned anything

about the *finger muscle attachments.* It was as if these conditions existed in isolation of one another or from any other part of the body. The structural area *as a whole* was never taken into account. I did find that to be *odd*.

These textbooks also never considered that the finger extensor muscles might be involved in tennis elbow, even though two of the main extrinsic finger extensor tendons originate from the lateral epicondyle. And two main extrinsic finger flexor muscles originate at the medial elbow. Even though both occur almost exclusively in grip activities. That also seemed *odd* as well.

The *wrist* extensor and *wrist* flexor muscles and tendons seemed to be the only focus of the textbooks, nothing about the hand muscles. That observation stuck with me in a subtle way, as I would later find out. I finally concluded that hand muscles have historically been *criminally* misunderstood and undervalued with regard to an array of conditions, pursuits, and applications.

My Story

My name is Dr. Terry Zachary, and I am the developer of the Handmaster Plus hand exercise system. To follow are the events that led me to its development, as well as most of what I have learned about this important area to date as a result.

I've always believed that it is beneficial for the reader to get to know the author who is providing them with their information. It is a way for the reader to get some idea of what makes the author tick. I hope to make this step easy for you because we can all learn from each other's experiences. This is my story in a nutshell…

I am proud to be born and raised in a small, wonderful Canadian prairie town in Alberta, Canada named Medicine Hat. Most in that area know it as 'The Hat.'

My natural curiosity for details may have been the result of my love for golf. Golf is a difficult and intricate game. It's as deep of a game and pursuit as you want to make it. You can never quite master it all.

The men and women who excel at golf are even better than most imagine they are. You'll see that for yourself if you attend a professional golf event live. Golf requires attention to mental and physical detail, mechanical detail, a grace beyond words, and a soldier's courage and fight that is hard to explain. Golfers themselves are constantly under immense pressure, especially when a potential failure or achievement is near.

Golf is an amazing sport from which to learn about oneself. It teaches one to be relentlessly *present*. And golf is a difficult game on the body, especially if you are not aware of your body and its requirements for balance. As a college golfer, and later as a professional golfer, I paid attention.

My two loves were indeed golf and fitness. Both came easy to me because both were my world and my training. But as I later discovered, that wasn't the case for very many golfers (or athletes, or musicians, or gamers or workplaces). Most were, and still are, blind to this entire grip muscle subject.

Why Hand Exercise?

My dad passed away suddenly in October of 1992. I quickly realized that life did not go on forever. It shook me to my core. At the time, though in private practise, I had been competing successfully on the side within the very difficult Vancouver golf tournament scene.

I had also had a successful college career, winning medalist honors 11 times in my 3 years while in Iowa. I lost in a playoff for the 1998 Quad City Amateur, then the biggest amateur tournament in the Quad City area. The winner, Ben Weir, went on to attend Arizona State and play with the likes of Phil Mickelson.

I knew that if I was going to make a run at playing golf professionally, I had to try now while I was still young. After all, I had an established career to fall back on.

So I chased my dream for three years: Mini-tours throughout the USA and Canada, and a handful of tournaments on the Canadian Tour (now the PGA McKenzie Tour). You are correct to conclude that I did

not make the PGA Tour, but I *was* awakened about a health and fitness issue that was rampant among professional golfers: Repetitive grip injuries. They were everywhere. And one player's injury still stands out to me more than all of the others.

I travelled with a very good player who had set aside a stable career as an automobile mechanic to also chase the dream of professional golf. But his situation was different; much different. He had a wife and two children at home counting on him. And he had developed tennis elbow. His need for a solution was urgent.

When I interviewed him about grip training, it was not a surprise that he answered that he squeezes a tennis ball to keep strong for golf. It's an answer I had heard over and over at that point from professional golfers who sought out my advice about upper extremity problems.

My next question to him was what he did to train the muscles that open the hand. He looked at me like I had switched languages. It is also a look I have come to know well from golfers, other grip athletes, musicians, gamers, computer users, grip-related workers, and hobbyists ever since.

I told my friend that we would stop at the next tournament city and I would find him an item or items with which to train his hand muscles - all of them - properly to rebalance his elbow musculature and stabilize this vital supportive area.

I couldn't find what I was looking for in that next city so, as called by urgency, I instead built a rough prototype of what is Handmaster Plus today. My friend's tennis elbow problem soon became stabilized.

It was about one year later that I made the decision to end my effort at playing professional golf. I was doing well, but several circumstances pulled me away. It is such a competitive pursuit. I learned so much, and I experienced so much. No regrets.

During the years spent chasing my dream, I became aware of a problem that I alone could solve: repetitive gripping. And it was

everywhere I turned; sports, music, ergonomics, gaming, computers, hobbyists, cell phones… everywhere. In the next few years, I returned to practise, and as well began to develop Handmaster Plus.

My *short peak* specifically into hand exercise, which was meant to last two or three years at most, has now lasted 25 years. Thus far, it has been quite a journey of surprises. And I'm sure the journey will continue in an equally unpredictable manner.

Each time I feel that I am near the end of learning about this intriguing area, a new concept erupts from within a current concept of interest, as if it grew out of new dirt. And then the new concept erupts and blossoms starting another concept and another new fundamental. Then another. And so on. That has been my experience. It is unexplored territory, indeed a rabbit hole, if one is paying attention.

But it seems as if few are paying attention. Now, after 25 years, I feel I have gained a strong grasp on what proper hand exercise really is, and more directly, how important it is to your general health, performance, and longevity.

I hope that you will read on to the very end and have your eyes opened up wide to this fascinating and important subject.

Thanks & nice to meet you. Please enjoy the book.

Chapter 1
Grip - Misunderstood for 5 Decades?

This book is about putting hand and grip strength exercise in its proper place – as a leading health habit. Currently, it is nowhere to be found. Even fitness fanatics and people who grip for a living mostly ignore it. The book will show the reader that grip exercise not only helps grip performance (and why), but also is essential for maximum health.

Get comfortable. We likely have *a ways to go* in the reader's beliefs about the hand muscles. Let's get started.

As I have moved through life, I have expanded my interests somewhat so that now I can probably be defined as a sport, health, *and music* enthusiast. Or more of a nut, I suppose. And a rebel. I can confidently say that if I had *no responsibilities* business-wise or family-wise, I would spend most of my time learning how to play guitar *better* and how to write songs *better*. I especially want to learn how to finger pick on an acoustic guitar.

Yes, I am now *that guy*, the *want-to-be singer/songwriter guy*. It just seems so cool.

And, of course, I would spend a lot of time cleaning up my golf game. For now, I continue to dabble in both on the side. I never mean to make any pursuit seem like it would be easy because true expertise always takes deep knowledge, application, and learning. It's just the way it is, and I happily accept that. If it was easy, everyone would be doing it.

I know that my pursuit of playing the guitar would take years of dedication, as would reviving my golf game. I'm always protective of the undervaluation of what it takes to be a master. Thus, when I'm told something that is intended to be factual in my current areas of

expertise, and it doesn't resonate with what I've learned or experienced, I don't swallow it.

Education should teach us to think, do, and explore the results, but not to memorize. The skill of critical thinking is at a crux in modern society. Traditional status quo has put us into to so many *belief* corners in so many subjects that we don't really know what is correct or untrue anymore, or natural or unnatural.

Just because we *believe* something ourselves, and it is familiar and comfortable *to ourselves*, doesn't prove anything to be truly *true.* We must listen to and experience multiple viewpoints from multiple experts and be ready to change our beliefs immediately, if needed.

As Robert Frost said, "We dance round in a ring and suppose, while the secret sits in the middle and knows."

Critical thinking of our own beliefs should be an active play. We should never be afraid to be wrong, or right. We should be committed to giving honest service to the principles of our pursuits.

In the mid- to late-1980s, I played basketball, golf, and hockey at a college level. In the early 1990s and through into the new millennium, I spent 10 years in private practice as a sports and family chiropractor. If that math appears loose, it's because I took a few years off from practice to pursue my dream to be a professional golfer. Somewhere in the middle, I began to dabble in guitar. I don't know if I was the most naturally gifted person at any of it, but I worked hard, studied hard, and observed carefully. I loved it all.

I never made it to the PGA Tour, but I felt very successful. And I observed carefully. I guess I was dangerous more than anything. Everything had to make sense to me and still has to today. Ask my wife. Ask my kids. It's been an excellent education. And it's an education I'm happy to say is still going on. And will keep going on always.

As mentioned earlier, in college, I was asked to prepare a report differentiating *tennis elbow (lateral epicondylitis)* from *golfer's elbow (medial epicondylitis).* Since I was going to be away from school for

one week for a college golf trip, I had to submit this paper upon my return. That paper sure made me think. Thanks, Dr. Percouco.

In all of the research, I found what led me to lay tennis elbow blame on a chronic overuse or acute injury to the *wrist extensor tendons*, and a chronic overuse or injury to the *wrist flexor tendons* for golfer's elbow. In other words, everything I researched about these conditions was *about the wrist muscles and tendons*. Elbow injury information is still *'wrist muscle-focused'* to this day, decades later.

But this explanation baffled me because I had been freshly educated in anatomy at that point in my studies. The wrist tendons *are not* the only tendons that cross the elbow. *The main extrinsic hand muscle tendons also cross the elbow* — at both the inside elbow and outside of the elbow.

Why are *they* not suspected?

At the medial (inside) elbow joint, the finger AND wrist flexor muscles and tendons form the inside forearm meat that flexes the wrist AND closes the hand. At the lateral (outside) elbow joint, the finger AND wrist extensor muscles and tendons form the outside forearm meat that extends the wrist AND opens the hand.

So why did (and do) health and fitness professionals and researchers not suspect the finger tendons in the development of tennis elbow and golfer's elbow? After all, in all of the high-risk activities listed for both tennis elbow and golfer's elbow, repetitive gripping was and is always a pervasive constant.

How could they miss this?

As a college kid, it seemed ridiculous to not explore grip and hand muscle health in relation to tennis and golfer's elbow. Since practicing for ten years, following professional golfers for 25 years and working with other various athletes, musicians, gamers and workplace environments for a further 20 years, I can confidently say that hand muscle health and balance is front and center in most, if not all, elbow injuries, including tennis and golfer's elbow.

I want to ask you a question. Nearly everyone has been told to strengthen his or her grip for one reason, or another. Were you told the same thing that I was as a young amateur athlete or musician? Something like: 'Take this grip ball, or squeeze ball, or spring loaded or coiled gripper and squeeze it. You'll get stronger.'

Are you familiar with those types of grip items? I sure was. It seemed like reasonable advice to a young kid. What are your beliefs about 'squeeze-only' grippers today? Do you think they are adequate to strengthen your hand muscles based on the little information I have exposed you to thus far?

It's entertaining to examine people's beliefs. As Guy Finley says, 'The truth is fun.' Squeeze, squeeze, squeeze, right? Is it the proper way to strengthen your hand muscles? Squeeze, squeeze, squeeze for hand health, strength, and fitness is *a belief*, not a truth. It is a belief I also had for many years until I researched tennis elbow and golfer's elbow as a college athlete back in the 1980's.

Now I think that hand exercise has been vastly misunderstood for 50+ years. Why? I'll spend the rest of the book detailing my reasons, but here are the 3 constant anchor points to consider.

1. *There are just as many muscles that open the hand (9) as close the hand (9).*

2. *The muscles that open the hand support the muscles that close the hand.*

3. *If the hand moves through a small range of motion only (i.e., only squeezing), maximum blood flow, lymph circulation, and nerve stimulation of the upper extremity are not possible.*

These three simple reasons are the crux of the rest of the book. And all three are vital to *your health, performance, and longevity.*

Does it seem like I am exaggerating? Please read on.

Hand muscles are super-important to you, me, and everyone. Let's learn them.

Chapter 2
Understanding The 18 Hand Muscles

For those readers who prefer **NOT** to get into the details of the layout of the hand muscles, rest assured, they are generally rather simple in lay out:

There are 18.

9 muscles open the hand.

9 muscles close the hand.

The muscles that open the hand are generally located on the **'back'** of the fingers, thumb, hand, wrist, carpal tunnel, forearm, and elbow. The muscles that close the hand are generally located on the **'front'** of the fingers, thumb, hand, wrist, carpal tunnel, forearm, and elbow.

If that's all you remember, that's enough. You'll never train grip or hand muscles wrong again.

In applications ranging from sports, music, therapy, gaming, the workplace, hobby & modern electronics, I can't say strongly enough how important I feel properly understanding the hand exercise and the grip is to your health, fitness, and performance.

Over these past three decades, my opinion of grip and hand strength training has changed substantially. Every year, through research, the author discovers more reasons why proper hand muscle training is vital.

The more that gets tested, the more details that get caught.

Learn the hand muscles and their vast reaches and effects, and you will understand their importance. In regard to the health & fitness

culture, we tend to move quickly past the hands and on to training the biceps, triceps, shoulders, back, and chest.

Exercises in these historically popular fitness areas have been demonstrated over and over for good reason. Yet not much consideration has been given to proper hand muscle exercise and overall grip training.

It serves anyone involved in grip-related activities well to study or reflect on the ***detailed and diverse attachment points and effects that the hand muscles have*** on the various joints and components of the upper extremity.

If you are a healthcare or fitness professional, it is a good idea to review grip muscles regularly. If you are like I was, hand muscle anatomy can get away on you quickly and easily! They're intricate and tricky. An occasional review can be very helpful.

So what is it about the diverse hand muscles that have left them to be so carelessly dismissed from all training protocols? They are a vital part of the fitness story, a vital part of the physical kinetic chain that allows us to train the entire upper body. Why are they left out?

The 'hand grip' is almost always ***the link between the user and the training weight or resistance*** in upper body training. Grip itself happens as a now known kinetic chain (a concept that will be covered in Chapter 3 - How Grip Works) that is essential to understand.

The health effects and imbalances of improper hand training cannot be overstated. Hand muscles attach at and therefore affect the stability of 7 key body structures, including the: **1) fingers, 2) thumbs, 3) hands, 4) wrists, 5) carpal tunnels, 6) forearms and 7) elbows.**

If you depend on your hands in your daily routine, this is a subject you need to have a grasp on, pardon the pun. Grip performance may seem adequate or even strong one day and be completely gone the next. That is always the nature of a chronic physical imbalance.

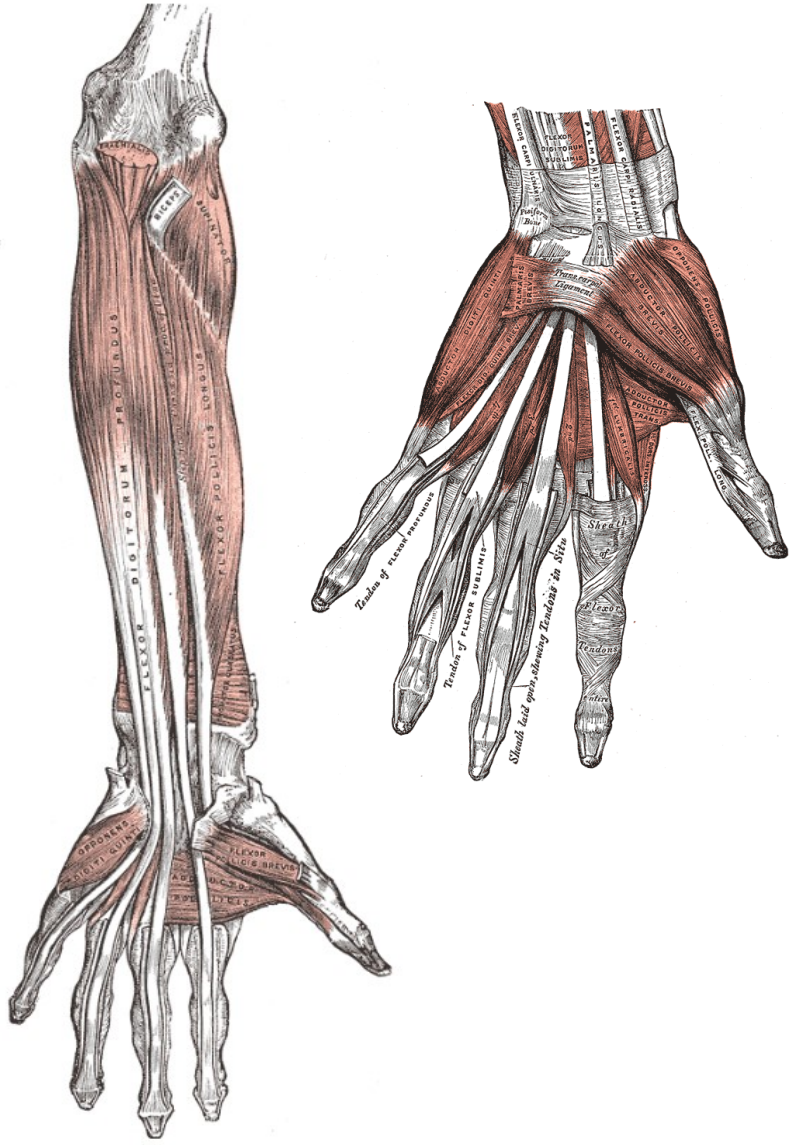


Fig. 1-2 The 9 Muscles that close the hand – General Anatomy

Ask any injured athlete in golf, tennis, hockey, baseball, or gymnastics, to name a few. Or ask an injured musician, serious gamer, check-out-clerk or dental hygienist. These imbalances can be debilitating, career threatening, and life-altering. We must understand how to properly strengthen the hands.

a) 9 Muscles Close the Hand

In an effort to illustrate the diversity of the anatomical area that controls the hand, let us now very basically examine 'The 9 Muscles That Close the Hand' and mention their general origin and insertion points to illustrate the diverse reach of each muscle.

This way, the reader can understand for him- or herself all the potential negative effects of hand muscle imbalance, as well as the positive effects of complete hand exercise.

The 9 Hand Closing Muscles:

1. *Palmar interosseous muscles* **–** Originate at the metacarpals **(hand**), then insert at the proximal phalanges **(fingers).**
2. *Adductor pollicus* – Originates at metacarpals **(hand)** and carpals **(wrist)**, inserts at the proximal phalanx of the **thumb**.
3. *Flexor digitorum superficialis* – Originates at the medial epicondyle **(elbow)** of the humerus, and at the ulna and radius **(forearm)**, inserts into middle phalanges of the **fingers**.
4. *Flexor digitorum profundus* – Originates at the ulna and interosseous membrane between the ulna and radius **(forearm)**, inserts into the distal phalanges of the 4 **fingers**.
5. *Opponens digiti minimi* – Originates on the transverse carpal ligament (the roof of the **carpal tunnel**), inserts at the metacarpal of the pinky **finger**.
6. *Opponens pollicus* – Originates on the transverse carpal ligament (the roof of the **carpal tunnel)**, inserts at the metacarpal of the **thumb**.

7. *Flexor pollicus brevis* – Originates at the transverse carpal ligament (the roof of the **carpal tunnel)**, trapezium, trapezoid & capitate bones **(wrist)**, inserts at the proximal phalanx of the **thumb**. Note that the trapezium is also a supportive bone for the thumb side of the **carpal tunnel**.

8. *Flexor digiti minimi* – Originates at the transverse carpal ligament **(carpal tunnel)**, inserts at the proximal phalanx of the pinky **finger**.

9. *Flexor pollicis longus* – Originates at the radius and interosseous membrane **(forearm),** inserts into the distal phalanx of the **thumb.**

Note that some experts may add another muscle to the muscles that close the hand: *Palmaris brevis* – which originates at the transverse carpal ligament **(carpal tunnel)** and **palmar aponeurosis**, and then inserts at the skin of the ulnar border of the **hand**.

As you can see in **bold font**, the hand closing muscles attach *throughout the upper extremity.* In other words, they are *hand muscles*, but they don't just affect the hands. They are at the core of so many hand actions, and thus, so many problems. Their general layout is easy to picture, but they are far from simple.

Thus, hand muscles will clearly have an effect on the health, stability, and performance of a diverse group of key joints and structures. Notice again that the diverse hand closing muscle attachment sites are at the **fingers, thumbs, hands, wrists, carpal tunnels, forearms, and elbows**. They will affect the stability of all of these areas!

If you can picture these muscle paths, try to also imagine how many areas they cross as they *'shorten'* when in use. More than anytime in history, we are a repetitive gripping culture. We must be aware. These 9 hand-closing muscles are regularly being shortened.

Any structure that they connect to is currently becoming shortened and imbalanced. Even if you likely don't *feel the problem* yet, the imbalance is occurring. What could these imbalances be

doing to your performance potential? Wouldn't it be wiser to simply keep these muscles in balance at all times?

Hand muscles clearly have diverse attachments and should be taken very seriously. They must be studied. They must be understood better. And they must be included in all health and fitness training protocols.

To maintain stability, performance, and balance, we must now learn the 9 muscles that open the hand and later learn how to train them properly.

b) 9 Muscles Open the Hand

In a similar fashion (and a similar pattern), let's now explore the lesser-celebrated '9 Muscles That Open the Hand.'

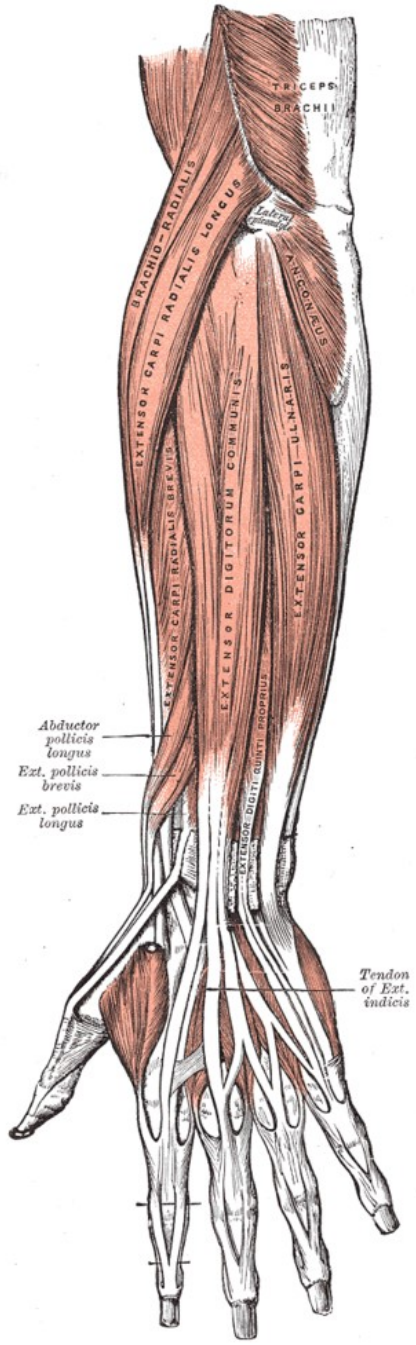
These 9, in essence, have been neglected in most hand training protocols for at least five decades, a fact that may contribute to more finger, thumb, hand, wrist, carpal tunnel, forearm and elbow problems than any other single underlying ingredient of cause.

The health and fitness effects due to improper hand training cannot be overstated.

Hand opening muscles attach at the front of the: **1) fingers, 2) thumbs, 3) hands, 4) wrists, 5) carpal tunnels, 6) forearms, & 7) elbows.**

By nature, the intricacy and organization of hand muscles and their movements are miraculous. When we train them, we must respect their anatomy and understand how all hand muscles work together in function and in stability.

Observe now the 9 muscles that open the hand and see their diverse attachments throughout at the back of the hand, wrist, forearm and elbow. Refer to diagrams 3 and 4 for general reference.


TRICEPS BRACHII
BRACHIO-RADIALIS
EXTENSOR CARPI RADIALIS LONGUS
ANCONEUS
EXTENSOR CARPI RADIALIS BREVIS
EXTENSOR DIGITORUM COMMUNIS
EXTENSOR CARPI ULNARIS
EXTENSOR DIGITI QUINTI PROPRIUS
Abductor pollicis longus
Ext. pollicis brevis
Ext. pollicis longus
Tendon of Ext. indicis

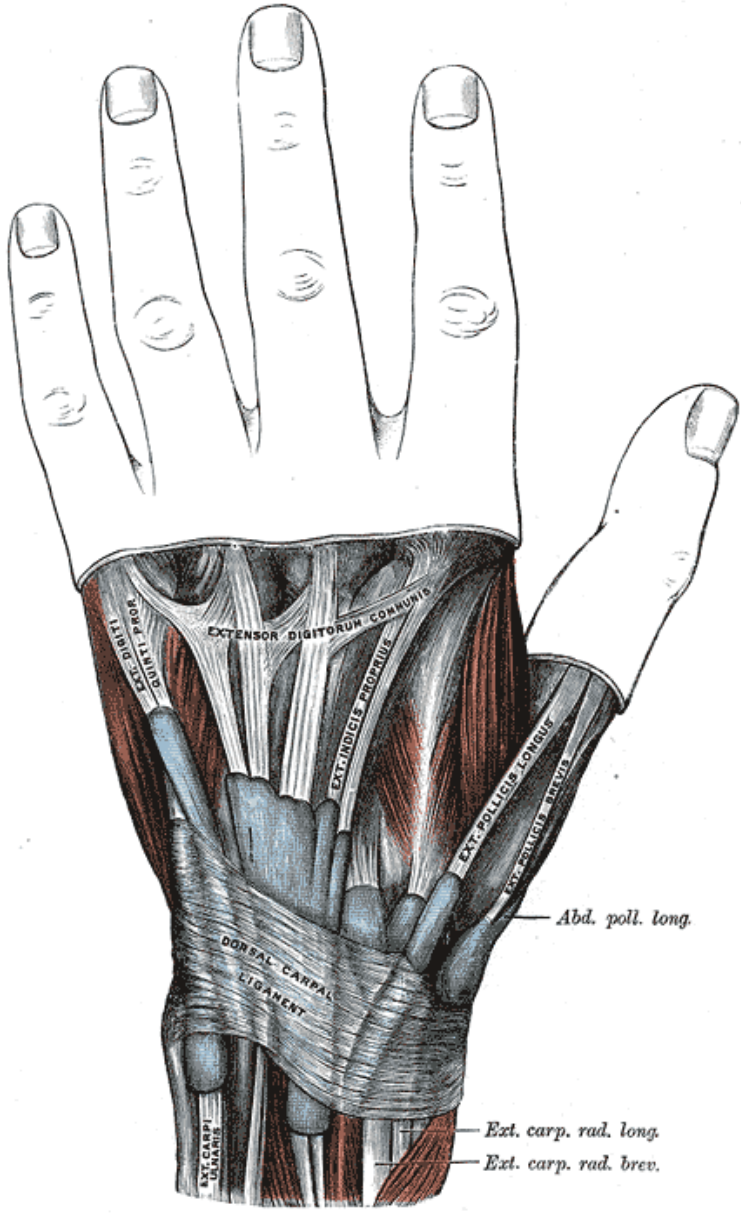


Fig. 3-4 The 9 Muscles that open the hand – General Anatomy

1. *Dorsal interosseous muscles* – Originate at the metacarpals **(hand),** insert at the base of the proximal phalanges 2,3,4 **(fingers).**

2. *Abductor pollicus longus* – Originates at the radius, ulna and interosseous membrane **(forearm)**, inserts at the distal phalanx of the **thumb**.

3. *Extensor pollicus longus* – Originates at the ulna and interosseous membrane **(forearm)**, inserts at the distal phalanx of the **thumb**.

4. *Extensor pollicus brevis* – Originates at the radius and interosseous membrane **(forearm)**, inserts at the proximal phalanx of the **thumb.**

5. *Extensor digitorum* **–** Originates at the lateral epicondyle of the humerus via the common extensor tendon **(elbow)**, inserts into the middle phalanges of the 4 **fingers**.

6. *Extensor digiti minimi* – Originates at the lateral epicondyle of the humerus via the common extensor tendon **(elbow)**, inserts into the extensor expansion of the little **finger**.

7. *Extensor indicis* – Originates at the ulna and interosseous membrane **(forearm)**, inserts at the extensor expansion of the index **finger**.

8. *Abductor digiti minimi* – Originates at the pisiform bone **(wrist/carpal tunnel)**, inserts at the proximal phalanx of the pinky **finger**.

9. *Abductor pollicis brevis* – Originates at the transverse carpal ligament **(carpal tunnel)**, inserts into the proximal phalanx of the **thumb.**

Notice *again*, that the 9 muscles that ***open*** the hand attach at the ***back*** of the **fingers, thumb, hand, wrist, carpal tunnel, forearm, and elbow** virtually mirroring the path of the 9 muscles that close the

hand. The balance of ALL 18 of the hand muscles will, therefore, have an effect on each of these joints and structures.

Now, ask yourself these questions: How often do you close your hands during your daily work, hobby, music, or sports pursuits? And how often do you open them? Repetitive gripping (or repetitive flexion) is a fact of life. It is not a fair fight. The muscles that close the hand are constantly at extreme risk of becoming dominant over the muscles that open the hands.

POOR POSTURE?

The structure and function of the muscles of the hand are very similar to that of the spinal postural muscles of the spine. The closing or flexing muscles are on the front, in general, and the opening or extending muscles are on the back.

Imbalance of the hand and grip muscles must be seen as ***poor posture***, just as imbalance of the spinal muscles is seen as poor posture. Both are rampant in our world, and arguably getting worse with cell phone dependence. Both lead directly to high health care costs and poor performance. Both are easily correctible, at low cost.

Poor hand muscle posture affects many joints and structures secondarily, including the fingers, thumbs, hands, wrist, carpal tunnels, forearms and elbows.
Poor spinal posture leads to spinal disk disease, back pain, neck pain, rib instability and nervous system challenges.

Let's be aware of both, stay healthy and be ready to stand tall and prepare for maximum performance.

In later chapters, we will learn how this chronic imbalance of the 18 hand muscles leads to joint and structure instability throughout the entire upper extremity, as well as to circulation limitations and maybe even health concerns.

If you remember only one concept from Chapter 2, let it be this:

'9 muscles close the hand,'

‘9 muscles open the hand.’

Now that you are at least generally familiar with the layout of the hand muscles, what we’ll examine next is another subject that is important to all, yet not well known to most: How Grip Works, including a key concept called *The Kinetic Chain of Grip.*

In other words, we’ll learn how muscles combine functionally to allow you to grip items and utilize your fingers.

Once you understand this basic concept, *the whole game changes.*

CHAPTER 3
HOW GRIP WORKS

In Chapter 2, we went over the general layout of the 18 muscles of the hand. This is such key information as a starting point for any discussion about the function of the hands and hand muscle training.

'9 muscles open the hand, and 9 muscles close at hand.' It sounds so simple, but now you ALSO know that these muscles have great and diverse reach, not only *within the hand* but also to the wrist, carpal tunnel, forearm, and elbow.

The veil is off. Hand strength and grip training is not a small subject. It relates to everything that happens at the mid and lower arm… and maybe even *further up*. Lots to come.

Kinetic Chain of Grip

Let's shed some clear and bright light on a new and vital grip concept that you will likely have little idea of, yet utilize every day. It details how grip works and is referred to as ***'The Kinetic Chain of Grip.'*** The phrase *kinetic chain of grip* simply means *'the sequence of peripheral muscle contractions that occur in order to grip something, grab something, or move the fingers and thumb to perform physical actions.'*

In other words, it is how your hands work. Once you know it, you will wonder how you as an individual or we as a health-and-fitness-conscious world ever trained the hands as we did.

We began to unravel the *kinetic chain of grip* by studying grip muscle contraction patterns in 2002 using sEMG (surface electromyography).

The *kinetic chain of grip* refers to the cooperative contraction of distinct muscle groups to produce a final desired action of grip or

grasping or pressing with the fingers and/or thumb. In order for grip to occur, the body, in its wisdom, must stabilize its base so as to connect 'the peripheral with the proximal.'

In simpler terms, it would do no good to grip a baseball with the fingers and thumb alone if the wrist were not first stabilized. The ball, fingers, and thumb would simply *fall and hang to the ground*.

That picture makes sense to most people… *especially pitchers! …lol*

Now the slightly tricky part of the grip that is illustrated well in our baseball grip example…

Most fitness trainers and therapists understand that the wrist muscles are active in stabilizing and gripping a baseball. But what about the *finger and thumb extensor muscles? What do they do*?

Fig. 5 Baseball Grip - Illustrating the Kinetic Chain of Grip

And what would happen if the *finger and thumb extensor muscles* were not providing any stabilization, meaning… not contracting? What would happen to the ball then? Would the player have control of it?

Please try it. Go grab a ball, or tennis racquet, or pen, or a toothbrush and feel what happens when you grip it. Feel the 'back of your hand' where your finger extensor tendons are (Review Chapter 2, if necessary).

Are they contracting? The answer is a resounding 'yes.' They have to be. Otherwise, the fingers would fall limp.

One might think that this doesn't make sense because finger extensor muscles and tendons are supposed to ***open the hand,*** not *close* it. Right?

Right! The finger extensor muscles *DO* contract to open the hand, but they ALSO contract '*in cooperation with the finger flexor muscles*' in a supportive role when gripping, grasping or pressing with the fingers, as in sports, music, computers, gaming, workplace, hobby and in general daily tasks.

The finger extensor and finger flexor muscles are constantly in a *'cooperative co-contraction'* when the fingers are gripping or active. This is what is meant by the *'kinetic chain of grip.'* The finger extensor muscles contract cooperatively to support the finger flexor muscles i.e., to grip.

It is a kinetic chain. And, as mentioned, *the kinetic chain of grip* can be shown clearly using surface electromyography (sEMG).

To date, the author has done dozens of sEMG muscle pattern studies in a variety of grip activities (sports, music, workplace, gaming & computers) in doing our grip research. The images are consistent, revealing, and super-interesting.

The sEMG signal above (Fig. 6) shows the sEMG pattern of a dental hygienist while performing teeth cleaning. Did you ever think that dental hygienists have a difficult physical job?

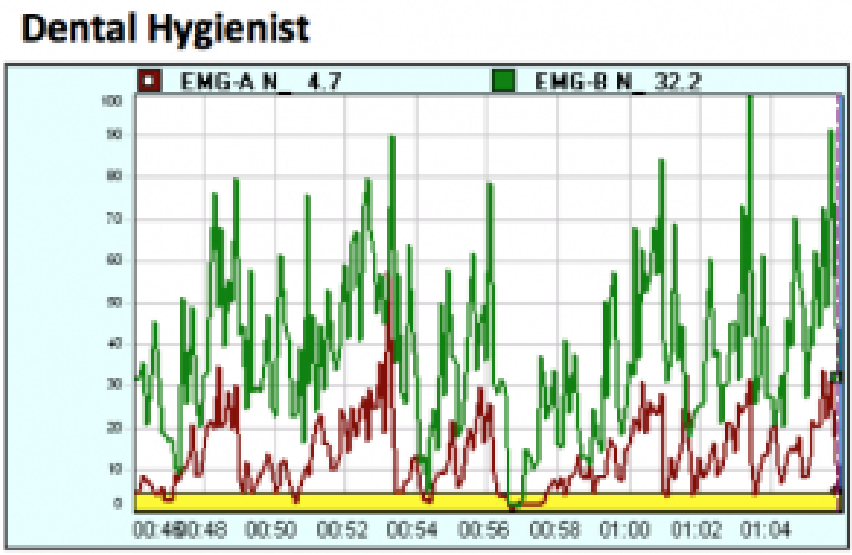


Fig. 6 Hand muscle fire pattern of dental hygienist.

Probably not. You were likely having other thoughts while having your teeth cleaned – like surviving!

But dentists, dental hygienists, and dental assistants do have demanding physical jobs, as do many repetitive gripping professionals and workers. In fact, dental hygienists have one of the most demanding physical jobs of any profession. Our sEMG patterns show it clearly. *'For real!'* as my daughter says.

And the main reason is because of the constant presence of an active *kinetic chain of grip*. Notice the green (top) signal that indicates the contraction of the *finger extensor muscles* on the sEMG chart above. The red (bottom) signal represents the *finger flexor muscle* output.

When the hygienist is cleaning teeth, BOTH the finger extensor AND flexor muscles are contracting… the whole time. Otherwise, the hygienist would drop the cleaning tool. Notice the intensity of the green finger extensor muscle pattern. This might surprise many people. It is a huge burden on the entire profession, as we will explain

in more detail in a later chapter. Indeed, we have much more to cover on workplace injuries due to repetitive gripping, later.

The baseball catcher sEMG chart below (Fig. 7) also shows the detailed pattern of both finger extensor (green - top) muscle pattern contraction in support of the finger flexor (red - bottom) muscle pattern when the catcher provides a target for the baseball pitcher (spike on left of the graph) and when the catcher catches the pitch (red and green simultaneous spikes near the right of graph).

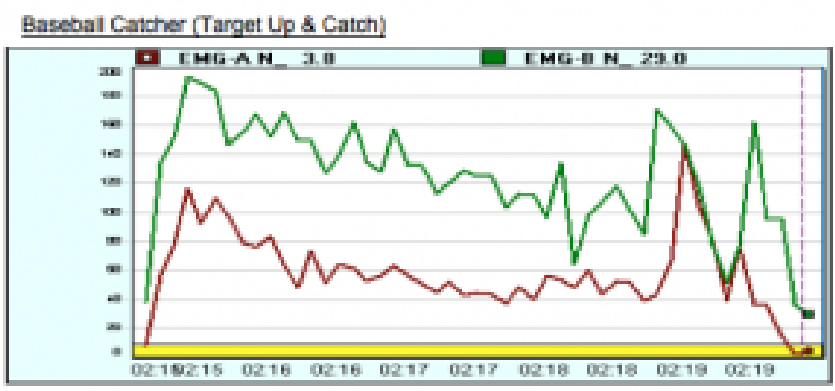


Fig. 7 Baseball catcher muscle pattern – target & catch

Again, the intensity of the *finger extensor muscle* signal (green - top) might surprise you. Most would expect the *finger flexor muscle* signal (red - red) only to be strong because historically, athletes think of *'grip-only'* and use *'squeeze-only'* training devices to prepare their hands for sport.

There is little difference in the study of the kinetic chain of grip in music.

The sEMG pattern below depicts the pattern of the *finger extensor muscles* (green - top) versus the *finger flexor muscles* (red - bottom) when viewing a guitar player's fret hand. Note once again the intensity of the green signal that represents the *finger extensor muscles*, or the *'support muscles'* in the *kinetic chain of grip*.

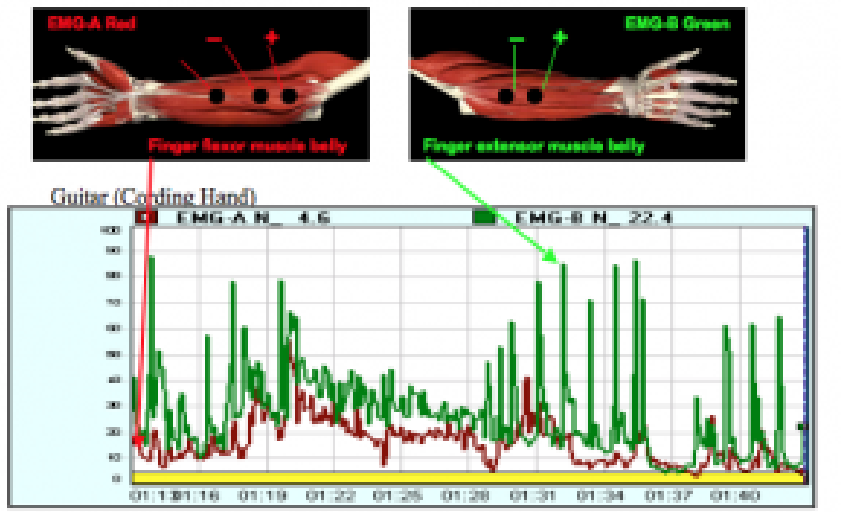


Fig. 8 Muscle fire pattern – Guitar (fret hand)

These patterns surprise experts and lay people alike. The finger extensor AND the finger flexor muscles contract together in cooperation in order to grip. Indeed, the finger extensor muscle fire pattern is always very intense in grip activities.

The music market is another example of rampant use of spring-loaded *'squeeze-only'* type gripping devices and grip balls. And the chronic injuries keep coming and coming for musicians.

In summary, *the kinetic chain of grip* refers to the fundamental concept that the finger extensor muscles contract to support the finger flexor muscles in any grip, grasp, or finger action.

Furthermore, the thumb extensor muscles contract to support the thumb flexor muscles in thumb flexing actions. More on the thumb later in Chapter 8.

It makes sense that, if the finger extensor muscles *are not* contracted, the fingers (with finger flexor muscles contracted) simply fall limply towards the ground. In other words, we can't leave out any

part of the kinetic chain out if we desire proper grip. It is a rather simple concept, though not at all well known.

For illustration, I often compare cooperative grip contraction (the *kinetic chain of grip*) to the sports discipline of **pair's figure skating**. We are watching the female skater eloquently complete all of the thrilling tricks, but the male partner skater is working well and hard in support to equally create the outcomes that we are witnessing.

The finger extensor muscles are the motor for grip. If one expects advanced strength, speed, stamina, stretch and grip performance, the finger extensor muscles must be properly trained and healthy through their full range of motion.

When an athlete's, musician's, worker's, gamer's, or hobbyist's grip weakens or fatigues, it is a clear indication that the *kinetic chain of grip* is weakened or broken down, not necessarily a *finger flexor muscle problem*, as was previously assumed.

In fact, the author believes that most grip problems have more to do with weakened *finger extensor* muscles (i.e., the grip support muscles of the *kinetic chain of grip*) than weakened finger flexor muscles (i.e., the grip action muscles).

When we make an effort at strengthening both the hand closing and opening muscles, we have the start of the stable *kinetic chain of grip*.

Ideal Wrist Position

Good so far?

The 9 muscles that open the hand co-contract with and thus support the 9 muscles that close the hand. Make sense? Ok. Good.

Now what muscles support the 18 hand muscles?

Our final basic grip concept prepares us for the rest of the material in the book. It is a final step in the *kinetic chain of grip* and

will help anyone who grips repetitively to understand individual grip challenges; and to also learn why proper grip training is so necessary.

This final concept related to Chapter 3 spawns from a study by Zhang Li at University of Pittsburgh in 2002[1]. Li determined that the ideal wrist angle for maximum finger force is 20 degrees of extension and 5 degrees of ulnar deviation. What this study suggests to us is that, given any individual grip situation, the body tries to find an ideal wrist position within which it can best perform its gripping task.

The *kinetic chain of grip* indeed extends past the hand muscles to next include the specific wrist and forearm muscles that control the position of the wrist. The grip activity itself determines the ideal wrist position and therefore determines which wrist and forearm muscles are most engaged.

WARNING! To follow is a list of these wrist and forearm muscles that control wrist position and motion. Unless you are a health or fitness professional, it is not necessary to know or review these muscles, just know that 'wrist position' is a key factor in how grip works. Know that each grip activity demands a unique and repeated wrist support position. Thus, wrist instability patterns will be specific to the specific grip activity. It is not one size fits all.

THAT SAID…we must also understand that when we train these wrist support muscles, we *SHOULD NOT* merely repeat the wrist position of the activity. Instead, we must train ALL wrist support muscles in all grip athletes, musicians, workers, gamers, computer users and hobbyists in balance through full, natural, 3-dimensional ranges of motion. Only then do we prepare the individual for maximum performance and injury prevention.

The muscles that control the wrist position are:

1) Extensor carpi ulnaris (wrist adduction & extension)

2) Extensor carpi radialis longus (wrist abduction and extension)

3) Extensor carpi radialis brevis (extension)

4) Flexor carpi ulnaris (wrist adduction and flexion)

5) Flexor carpi radialis (wrist abduction and flexion)

6) Palmaris longus (flexion)

7) Pronator teres (pronation)

8) Pronator quadratus (pronation)

9) Supinator (supination)

In order to produce Great Hands, we must always consider the healthy strength, balance and circulation of the wrist and forearm muscles that support wrist position and, in turn, the actions of the hand.

In sports, music, workplace, gaming, computers and hobby, the hands and wrists must be trained not only for maximum performance, but also to avoid repetition and overuse imbalances that are inherent in the activity.

All who depend on grip must properly train: 1) the 9 hand closing muscles, 2) the 9 hand opening muscles AND 3) the 9 wrist support muscles. They must ensure that their *kinetic chain of grip* is well understood and well attended to.

Refer to the Handmaster Plus 'Figure 8 Exercise' in Chapter 9 to understand how easily and conveniently this can be accomplished in one easy, continuous exercise, using Handmaster Plus.

Over time, repetitive gripping habits threaten to create diverse challenges throughout the finger, thumb, hand, wrist, carpal tunnel, forearm and elbow complex. It doesn't matter if the individual that grips is an athlete, musician, worker, computer user, gamer or hobbyist. The same challenges face all repetitive grippers.

Repetitive gripping leads to: 1) muscle imbalance, 2) structural dysfunction, 3) shortening and thickening (stenosis) of repetitively used muscles and tendons, and 4) poor circulation. Without proper

training, any or all of these challenges can show up as symptoms at any structure along the kinetic chain.

Hockey players stick handle, shoot and pass pucks, all while gripping a hockey stick in a very small range of hand and wrist motion. They train regularly. They practise regularly. They play regularly. Their hand closing muscles are contracting constantly to hold their stick. Their hand opening muscles are contracting constantly to support their hand closing muscles. Their wrist and forearm muscles are contracting repeatedly to support their wrist position. All is happening through very small ranges of motion for specific hockey demands. Muscle imbalance and shortened, thickened wrist and elbow tendons wreak havoc in the sport. Corrective exercise is a constant need for performance and injury prevention.

The gamer's finger and thumb flexor muscles are contracting repeatedly to work the game controller, keyboard, or mouse. Their finger and thumb extensor muscles are contracting repeatedly to support their finger and thumb flexing muscles. Their wrist and forearm muscles are contracting constantly to support their wrist position. All is happening through very small ranges of motion for specific gaming demands. Specific gaming and esports activities each have specific yet similar *kinetic chains of grip.* Muscle imbalance is rampant and wrist and elbow injuries are common in gaming and esports. Corrective exercise is a constant need for performance and injury prevention.

Sound familiar? Each kinetic chain in each grip activity could be explained in this same fashion. We could explain sewing, tennis, jet-skiing, gardening, surgeons, crafting, paint spraying in an autobody shop, etc., the same way.

We could go on and on.

Each *kinetic chain of grip* is similar, yet unique. Each grip activity demand is unique. Yet, each grip training protocol is *the same*. Understand how grip works. Understand the *kinetic chain of grip*. Understand the muscles involved. **Strengthen and balance all**

grip muscles properly to maximize performance in any grip activity, as well as injury prevention.

Simple as that.

The Palm-Down Hand Position

One day as the author was performing an sEMG muscle pattern test on a guitar player, the guitar player leaned back nearly to his back. The finger extensor muscle signal on his fretting hand went crazy, and a significant lesson was learned. When the hand is working in a 'palm-down' position, another stress is introduced to challenge the fingers extensor muscles – *gravity.*

This explained a great deal because, until that time, the author was stunned that seemingly non-major physical actions (i.e., computer use, gaming, piano, dental, etc.) produced dramatic finger extensor muscle output signals.

Once observed, it becomes obvious that when the hand is in a palm-down position, the finger extensor muscles are doubly burdened. They contract in order to: 1) support the action of the finger flexor muscles (i.e., in the *kinetic chain of grip*), and 2) support the fingers against gravity.

Factors That Challenge Grip

Several factors were discovered via sEMG that help to analyze the intensity of grip and thus the likelihood of injury in any given grip activity.

They are: 1) **Pressure** required for activity (i.e., high for a climber, low for a computer), 2) **Size, shape and weight** of the item being supported (Extreme (big *and* small) items demand more grip muscle output; items that are the size of the hand require least), 3) Is the item **Moving or striking**? (i.e. golf club, tennis racquet, vibrating handles in the workplace require more grip output), 4) **Position** of the hand (*palm-down* hand position = more stress on the wrist and finger extensor muscles, *thumb-down* position = more stress on the thumb extensor muscles), 5) **Range of Motion (ROM)** (repetition in small

ranges of motion creates imbalance via adaptive shortened muscles and tendons), 6) **Length** of grip activity (longer time = more fatigue, *kinetic chain of grip* muscles work harder, longer and less efficiently), 7) **Rest time** (are the grip muscles given time to rest and recover?)

Feel free to evaluate your own and other grip activities, or if you are a health or fitness practitioner, evaluate the activities of your patients. You will find that the health of the *kinetic chain of grip* is indeed largely taken for granted.

Now that we understand the *kinetic chain of grip*, we complicate matters a lot. We are a repetitive grip society. We must start to understand *from where* mechanical problems of the fingers, thumbs, hand, wrist, carpal tunnel, forearm, and elbow originate. We must also be prepared to change our training approaches to prevent and correct these very debilitating and costly problems.

One of the most common of these problems is tennis elbow, or *lateral epicondylitis*. It is an eye-opening topic that will be deeply discussed in Chapter 4.

Tennis elbow is a direct reflection of our very core misunderstanding of grip.

Do we really understand tennis elbow? Are we approaching tennis elbow training, prevention and recovery properly?

The truth is, we now *finally* have a chance at understanding tennis elbow because we now understand how grip works.

Chapter 4
Tennis Elbow Opened My Eyes

The prevalence of tennis elbow (TE) in our society today is a direct reflection of our very core misunderstanding of grip and grip training. With our modern dependence on phones and computers, grip training cannot continue to be misunderstood any longer. We are breaking down physically as a society, and must learn how to keep our bodies functioning maximally.

We've helped a lot of people with TE conditions over the years, both in treatment and prevention, and in the prevention of reoccurrence in post-treatment recovery situations. That said, my journey through this condition has been humbling, to say the least.

Studying and treating TE and carpal tunnel syndrome have been my two greatest single teachers for understanding grip strength training mechanics and learning how to properly approach hand muscle exercise.

Thus, tennis elbow is a subject that is near and dear to my heart.

I know that you will find this chapter to be eye opening. Our hands are more at risk now than ever. Which means *so are our elbows…*

In Chapter 2, we went over the general layout of the 18 hand muscles. In Chapter 3, we learned how grip works by examining the *kinetic chain of grip*. We are building a strong base with which to truly understand our hands, our grip, proper hand exercise, and all related health and performance principles of the upper extremity.

Chapter 4 and Chapter 5 may be the most important sections of these entire teachings. They are doozies! They WILL affect hand exercise and grip strength training programs around the world. When we examine the cause of tennis elbow, we cannot escape the direct

connection of grip mechanics to elbow mechanics… and we, in turn, open up a whole new can of worms.

Before you begin, please ensure that you are super-comfortable with Chapter 3 – How Grip Works. If you understand Chapter 3, Chapters 4 and 5 will be much easier to process, possibly even be obvious. Share this chapter with EVERYONE you know who depends on, trains or treats hands and elbows. TE is *that prevalent of a problem,* with nearly everyone.

TE, at it's core, is an imbalance. It is an imbalance that mostly develops subtly. If you are not currently suffering, I can nearly guarantee you have some weakness and imbalance at the outside elbow, unless you are already knowledgeable of our current training. In other words, everyone could benefit greatly *as of TODAY* from understanding TE, especially if you are grip-dependent in your work, sport, musical pursuit, esport, or hobby.

Sound over-hyped? Unless you are already in our inner circle, this will be brand new information to most of you regardless of how advanced or accomplished you are within your healthcare or fitness field. Unfortunately, TE is not historically a very sexy subject and thus has not been dug into deeply.

The mainstream health term for TE is *lateral epicondylitis*, where '-itis' means *inflammation* at the *lateral epicondyle*, the bony protuberance at the outside of your elbow, the far end of the upper arm bone (the humerus).

See what I mean? Not very sexy.

I remember seeing TE cases when I first started in private practice. To me, these were nearly nuisance cases; not the least bit exciting. 'Your elbow hurts? Is it inflamed? Did you over-do it? *Ice it, rest it, and suck it up*' was basically my thought and approach. My success rate, not surprisingly, was low. I became more and more interested as I smartened up. I was forced to, so I began to dig deep as I saw the huge prevalence of tennis elbow cases, especially in sports and music (and eventually in the workplace).

I was reminded of my college paper comparing TE to golfer's elbow and my intuitive question: 'Why doesn't anyone examine the role of the hand muscles in elbow problems?' In honor of those first poor TE patients of mine, I'd like to entice everyone to do the same thing. Dig deep and understand the relationship between grip and tennis elbow. It will affect you. It already has.

Once you dig deeper into TE, it will be much easier to explore all grip dilemmas at the elbow that follow in this book.

A Question That Must Be Asked: Is Tennis Elbow (TE) Caused By One Muscle?

If you read articles about the *'cause'* of TE, you will see that inflammation of the *extensor carpi radialis brevis (ECRB)* muscle tendon is often the focus. It's a fancy Latin name, but the ECRB muscle is simply one of the muscles that aid in extending your wrist *backward*.

Even though *grip activities* are always cited as high-risk factors for TE, *grip itself* is never examined closely as a suspected cause. As the reader knows, that has always seemed odd to the author.

It's as if there is no awareness that finger extensor muscles attach at the lateral epicondyle. You learned this anatomical truth quickly in Chapter 2. How could *it be missed*? The theme remains the same to this day. Have a Google search if you wish. Look to see if you can find anyone that focuses on any finger extensor muscle in relation to TE. Go ahead, I'll wait.

My bet is that you were unsuccessful.

Or did you find a small study[2] of 13 subjects done in Royal Melbourne Hospital, Parkville, Australia that found a high prevalence of positive pain on resisted extension of the middle finger (Maudsley's test) in TE cases? The conclusion of that study in relation to the extensor digitorum muscle and TE was: 'The muscle may play a greater role in tennis elbow than previously appreciated.'

Bravo! Great stuff!

But only one study.

My hesitation with the traditional *'one muscle cause of TE'* theory is two-fold.

Fig. 9 Grip Activities, Common Cause of Tennis Elbow (Lateral Epicondylitis)

Firstly, there are ***five extensor muscles*** that attach at the lateral epicondyle, not one. Three of these muscles are indeed wrist extensors (one of the three being the ECRB muscle), but two of the five muscles are finger extensor muscles (one being the *main* finger extensor muscle, *extensor digitorum*).

These five muscles attach to the lateral epicondyle via the ***common extensor tendon***. TE occurs when the *common extensor tendon* is overused, breaks down, and becomes unstable.

It is difficult to conceive that *the common extensor tendon* (made from 5 extensor muscles) itself is perfectly stable *except for the ECRB muscle.* Yet, this has been the knowledge for at least the last 30 years.

The finger extensor muscles are almost never suspected as causative (of TE). I believe this is because health and fitness experts are not familiar with the key basic concept of the *kinetic chain of grip* (covered in Chapter 3).

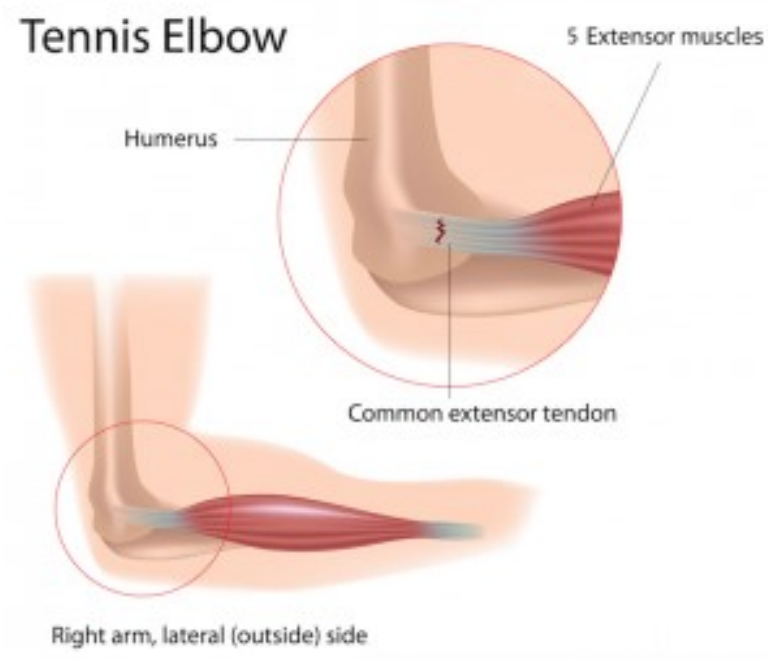


Fig. 10 Common Extensor Tendon Weakness – Core Cause of Tennis Elbow

The second misgiving I have with the *'one muscle causes TE theory'* is that most therapists and trainers actually *DO* train the wrist extensor muscles. Wrist muscles are popular and quite easy to train traditionally.

Therapists and trainers, in general, *are aware* of the importance of wrist muscle strength and balance. No serious tennis player, hockey player or golfer omits wrist muscle training, yet these athletes still *DO* develop TE. Why is that?

I believe strongly that current wrist muscle strength training methods may be *contributing to TE* cases (and other elbow problems), rather than solving them. Wrist extensor training is always done while gripping an item (i.e., a dumbbell, a kettle bell, or a weighted dowel, for example). In other words, the resistance is actively being *gripped* throughout the wrist exercise and is thus creating ***further static, inflexible finger extensor muscle tone*** (via the *kinetic chain of grip*), though intending to strengthen the wrist extensor muscles alone.

Whoa, a complicated previous sentence, but remember, when we grip something the finger extensor muscles contract to support the finger grip muscles. If we *grip* when we train the wrist and forearm muscles, we *accidentally* create a dilemma at the elbow.

The historic over-simplification of the cause, diagnosis, and treatment of TE led the *'old me'* to initially ignore TE's importance and diversity. Years later, after much experimentation, feedback, and study, I know that TE is a debilitating cry from the body for balance and understanding, not just an inflammatory inconvenience.

Old ideas remain as dogma while TE prevalence continues to rise. But if the oversimplified *'one muscle causes TE'* theory isn't the real cause, what then is?

In studying grip and upper extremity mechanics, specifically for over 30 years, I believe strongly that the high prevalence of modern TE or lateral epicondylitis is due to 3 main factors:

1) A ripening of the baby boomer generation who have been repetitively gripping for a lifetime and are now focusing on retirement grip sports (pickle ball, tennis, golf, etc.), music pursuits (guitar, piano, etc.), and other grip-related hobbies (i.e. gardening, painting, woodworking, crafts, automobile restoration, etc.)

2) The prevalence of our electronic-age daily repetitive finger motions (i.e. cell phones, computers, gaming and esports, etc.),

3) A continued poor understanding of grip mechanics, grip training (i.e. using stress balls and other 'squeeze-only' grip training devices) and hand musculature.



Fig. 11 Dental Grip Fig. 12 Smartphone Grip Fig. 13 Hobbies Grip

Review Chapter 3 and remember how grip works. Every time we grip or squeeze, the finger extensor muscles contract in support. Yet they never contract through their true full range of motion, do they? In other words, *the hand rarely opens.*

Thus, finger extensor muscles are trained statically when we squeeze or hold something repetitively — in one shortened position. Unfortunately, static muscles breakdown eventually, inflame, thicken in repair (stenosis) and become easily injured. Static muscles lose flexibility and develop poor blood flow and lymph drainage, both of which are necessary for keeping tissues healthy.

Can you imagine holding a brick in one position for 5 minutes and telling people you were strengthening your biceps muscle? People would think you were crazy. Yet that's exactly what we do to our finger extensor muscles when we grip and squeeze. We train them statically. We set them up for injury.

And remember, the main finger extensor muscle is one of two finger extensor muscles that attach at the lateral epicondyle via the common extensor tendon, the main tendon that is inflamed in cases of diagnosed tennis elbow.

Of course it is perfectly sensible to believe that any or all three of the wrist extensor muscles may be contributing as causative of TE, but why has just the ECRB muscle been the focus? We know from studying the *kinetic chain of grip* that wrist extensor muscles are likely active in supporting the position within any grip activity.

The author believes repetitive gripping *is a direct causative factor of chronic TE.*

Yet, most current grip training ideas *focus on* 'squeeze-only' exercises. Finger extensor muscles contract statically to support the finger flexor muscles. Over and over and over, this 'squeeze-only' approach entices the same static, weak, inflexible finger extensor tendons that attach at the lateral epicondyle, via the common extensor tendon.

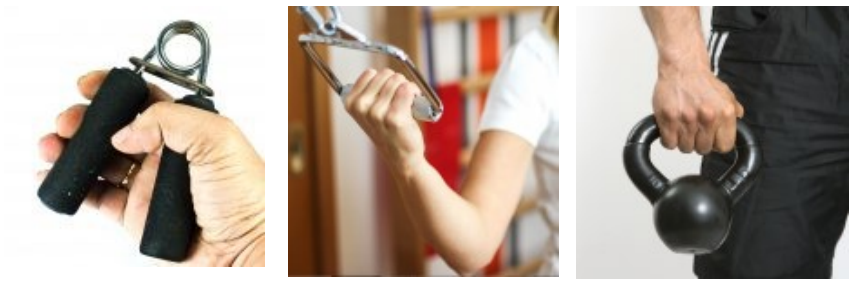


Fig. 14 Clenched Hands in Fitness Training

Additionally, when other muscles are trained in fitness (wrists, forearms, biceps, triceps, shoulders, back, chest, etc.), a weighted resistance is almost always being held via a 'clenched hand (Fig. 14),' further training *finger extensor muscles repetitively and statically*, further leading to weakness and overuse, further leading to inflammation at the lateral epicondyle… and further leading to TE.

Enough about the problem. What about a solution?

It is for the previous reasons that the author believes that wrist extensor muscles should be trained with the hand ***open*** against resistance.

See Chapter 9 (*Figure 8 Exercise)* for a simple, yet advanced and complete training approach that trainers and therapists should learn and understand. It provides all grip athletes, musicians, workers, gamers, computer users and hobbyists with a go-to forearm and grip exercise that leads to the overall stability, performance and health of

the fingers, thumbs, hands, wrists, carpal tunnels, forearms and elbows.

The 'Figure 8 Exercise' also adheres properly to all principles of the *kinetic chain of grip*. *Never again will grip exercise lead to TE or any other imbalance.*

We must learn to stabilize *all five muscles* of the common extensor tendon that attach at the lateral epicondyle if we expect to see TE go away and stay away. Only then will we see elbow performance potential and stability maximized.

Could researchers approach TE more intuitive and break down the circumstances of each individual TE case? For example, it would help to know: 'What is the common angle that the wrist is being held at daily in each TE case? And what is the dominating wrist and grip motion that a TE sufferer performs at each day?"

We cannot oversimplify TE to the point where we ignore the specific demands (especially specific grip demands) of each individual sufferer. We must learn individual cause.

The author believes that in order to gain a deep understanding of TE, researchers must gather: 1) case studies of the specific grip and wrist position demands of individual TE sufferers, as well as 2) information regarding the resultant state and structure of the common extensor tendon of those individuals.

Numerous studies (and study reviews)[3456] have been completed by varying researchers, none of which mention the connection of repetitive grip as a cause, nor finger extensor muscle training or elbow muscle strength and balance training as a solution.

Our company is always happy to supply product for any student or researcher who would endeavor to test the effect of complete grip and elbow exercise on TE, including proper hand and wrist muscle exercises.

The examination of the cause of tennis elbow may seem somewhat complicated at this point. I've likely muddied the waters

for many, but I have found the solution for general elbow health is simple. No matter your activity, maintain the strength and balance of all of the muscles of *the kinetic chain of grip.*

Again, feel free to skip to Chapter 9 to have a look at how we train the very important grip and grip support muscles using The Figure 8 Exercise. It is a simple yet thorough training. You'll be amazed by how many muscles are involved in the exercise. But please come right back. There is much more to examine at the elbow.

Next, we examine further – likely for the first time – why repetitive gripping, poor grip understanding and poor grip training have been the root cause of an array of elbow health and performance problems, including TE.

Continue to Chapter 5 – The Grip Dilemmas at the Elbow, and the grip picture will become much more clear.

CHAPTER 5A
GRIP DILEMMAS AT THE ELBOW (CORE)

The current Chapter 5a, together with Chapter 5b, may appear long and arduous to some readers. I apologize in advance. Please just try to stick in there. The elbow is wrought with insult because of chronic repetitive gripping. You are about to explore many interesting concepts that will lend to your understanding how the elbow works in relation to grip.

Remember also that the reader will be exposed constantly to these elbow insults for the rest of their life. It is time well spent.

The author is hopeful that by the end of these two chapters, the link between the grip and the elbow will be clear as day. Too many people suffer – and so many more WILL suffer – if we don't draw attention to these correlations. You'll soon understand.

A quick review. You've learned thus far (Chapter 2) that *the 9 muscles that open the hand* are generally located on the **BACK** of the fingers, thumb, hand, wrist, carpal tunnel, forearm, ***and elbow***. Similarly, *the 9 muscles that close the hand* are generally located on the **FRONT** of the fingers, thumb, hand, wrist, carpal tunnel, forearm, ***and elbow***.

You've learned (Chapter 3) that when we grip or grasp something, the *hand opening muscles* contract statically as part of the *kinetic chain of grip* in order to support the action of the *hand closing muscles*. Plus, the specific muscles that control the wrist position contract to support the hand actions. Grip, via the kinetic chain, is a well-orchestrated, cooperative co-contraction.

In Chapter 4, you learned specifically that two finger extensor muscles contribute to form *the common extensor tendon*, which becomes instable and inflamed in cases of *tennis elbow.*

Review

Whew. That seems like a lot, but is really just basic factual information about grip and hand muscles that have traditionally been unknown, or overlooked, or have simply drawn little interest and discussion, or *all of the above.*

Historically, when it comes to *gripping* in general, there has somehow been a firmly established belief that 'squeeze-only' is how grip works, as if the end of the story. You've heard it. I've heard it. Everybody I discuss it with has heard it. 'Grab a squeeze ball or a coiled or spring-loaded grip device or ring and start squeezing.'

In other words, it has been quietly accepted that the *hand-closing* muscles ONLY are at work when it comes to gripping or grip training. It is a belief that needs to dissolve. NOW. I beg of you… Let this idea go.

For the last 5 decades, I believe this 'squeeze-only' perception has created many and varied limitations and problem conditions for athletes, musicians, workers, gamers, hobbyists, and mankind in general, no more so than its many detrimental effects on the elbow.

So, what is meant by *'grip dilemmas at the elbow?'*

The author has struggled for many years regarding how to present the many elbow-related abuse findings that have been discovered related to repetitive grip. It is so under-the-radar yet so diverse that explanation becomes a true challenge.

To introduce this concept properly requires 7 subtitles. The first 3 are *core grip dilemmas* at the elbow (i.e., depicted to follow as 'Core') that occur simply due to the mechanics of gripping. The final

4 grip dilemmas at the elbow (Active) occur as a specific result of *gripping combined with stressful motion.*

Dilemma #1 (Core) – Static Finger Muscles

As we discussed earlier in Chapter 4, we were able to observe how the *kinetic chain of grip*, if unattended, results in chronically shortened and static finger extensor muscles. Two finger extensor muscles (i.e., extensor digitorum, extensor digiti minimi) contribute to the common extensor tendon that originates at the lateral epicondyle.

Instability and overuse at the common extensor tendon create the breeding ground for injury and swelling at the lateral epicondyle, thus lateral epicondylitis, or TE.

I've repeated myself many times about this concept by design because readers should not breeze over such a concept. Repetitive grip creates static finger extensor muscles that are easily injured. That is a major grip dilemma.

Finger extensor muscles serve two functions. They: 1) open the hand (i.e., extend the fingers), and 2) support the grip by contracting statically in support of finger flexor muscles. The first function allows these extensor muscles to act through their full range of motion (ROM). The second function (grip support) is essential, but is STATIC. Our ED (extensor digitorum) and EDM (extensor digiti minimi) muscles are being built statically.

Ask yourself: How often do I perform the first function and simply open my hands? The answer is – most commonly – rarely, if ever. Ask yourself also: How often do I open my hand *against resistance?* The answer: Likely, never.

Yet how often do I grip something *against resistance?* Answer: Often. Think about sports, music, work, art, gardening, briefcase carrying, coffee cup holding, fitness, dumbbell & kettlebell workouts, hand-shaking, cellphone holding and operating, painting, cleaning, repairing, maintaining, grabbing, helping, etc. The list goes on and on.

Fig. 15 ECRM & ED Muscles Gripping

We are all constantly gripping, constantly shortening our finger flexor muscles, constantly creating static finger extensor muscles. Constantly…

Our society's finger extensor muscles are being developed so *statically* that the author believes they could eventually become a cog in the evolution of societal health and performance. For most of us, our elbows are in a state of *sub-acute tendonosis*, meaning they are instable, unhealthy and thickened (as a result of natural repair), but not yet causing problems. I know, I know. Sounds dramatic.

Next, add to the equation that *if we do* decide to exercise our hands, it is very commonly accepted that we perform aggressive

repetitive gripping exercises through small ranges of motion using squeeze balls, rubber rings, coiled or spring-loaded grippers, and the likes. I've seen it again and again first hand with athletes and musicians, many of whom are world-class professionals.

In essence, we are compliant in creating the grip dilemma of weak, static finger extensor muscles, diminishing grip strength and vast hand muscle imbalance.

Yes, we are compliant in creating *'an unfair fight'* between the strength of our hand closing muscles vs. the strength of our hand opening muscles.

Which leads us to our next grip dilemma…

Dilemma #2 (Core) – Imbalanced Finger Flexor vs. Extensor Muscles.

It is understood in fitness that when one exercises their chest muscles, they will likely equally address the training of their back muscles. The same can be said for all body areas including the biceps and the triceps, the quadriceps and the hamstrings, the stomach and lower back, as well as the left side of the body compared to the right. We are striving for strength and balance. It only makes sense.

In order for our bodies to move maximally in 3 dimensions and stay in balance, we must always consider the harmony of the opposites.

Why then has this balance been ignored when we speak of the hand muscles? For a person (the author) who has studied hand muscle structure and function specifically for over 30 years, the oversight is truly confusing.

The hands are *not* boring. They are quite the opposite; *they are fascinating.* I hope you are starting to agree.

9 muscles close the hand, and 9 muscles open the hand. Some muscles are intrinsic within the hand. Some muscles are extrinsic, largely existing outside of the hand and crossing many other joints

and structures. Nerves weave in and out and over and through to help with life's daily demands. It is a simple, yet super-intricate design.

The hands are also *completely relevant* because hand muscle strength and balance directly affects the fingers, thumbs, hands, wrists, carpal tunnels, forearms, and elbows. They affect your health and performance.

Yet if fitness and health leaders and exercise markets continue to misunderstand the importance of a healthy balance within the hand muscles, the elbows (as well as other structures) will remain imbalanced in this grip dilemma.

Repetitive gripping is a direct burden on the medial epicondyle (medial epicondylitis or golfer's elbow) due to finger flexor muscle overuse and shortening without healthy opposition.

How many tradespeople, body-builders and fitness enthusiasts do you see with chronically flexed/curled fingers? It is directly due to chronic finger flexion imbalance habits with no opposing finger extensor muscle training. And it creates imbalance at the elbow.

The author refers to this appearance as 'Lego-hands' as it mimics the hands of Lego characters. It is neither healthy nor functional, yet is so commonplace that we don't question it. Lego-hands are indicative of a chronic hand closing muscle dominance vs. hand opening muscles. It suggests an imbalance not only of the elbows, but the entire finger, thumb, hand, wrist, carpal tunnel, forearm and elbow complex.

When I see extremes of the 'Lego-hand' appearance (usually in big, stout-looking athletes and tradespeople), and they try Handmaster Plus for the first time, these individuals are very weak through finger and thumb extension and spreading, no matter how strong they appear.

Finger extensor muscle bellies can *appear strong* when *'looking'* at an individual's forearm. They can *appear toned*, even bulky, but static muscles are not strong, stable, functional, or healthy. Training

the hand muscles in proper balance will soon offset this elbow imbalance grip dilemma.

Does the future sound bleak for society's current elbows? Without a new level of study, open discussion, and proper training, I believe it is. But it doesn't have to be. As a whole, we simply have to become familiar with the actual structure and function of the hand muscles, and then train them properly.

Fig. 16 'Lego Hands' on Gymnast

When we train all of our hand muscles through full, natural opening with resistance and full, natural closing with resistance, we also solve the 3rd core grip dilemma at the elbow…

Dilemma #3 (Core) – Poor Circulation

This dilemma used to be *barely on the author's radar*, but has now moved to where I believe it likely should be challenging to be #1. Unfortunately, it takes a bit more explanation and levity from the reader to consider. I don't want to scare people away. That's why it's #3.

When we repetitively grip, we are not truly exercising ANY of the 18 muscles *maximally.*

Think about it. The finger flexor muscles are generally closed ***fully*** when gripping (think of golf, tennis, carrying a suitcase, gripping a coffee cup or a steering wheel, etc.). They are not fully active, and they are not contracting through much of their *active range of motion (ROM)*.

'Squeeze only' grip devices are also guilty of not taking the hand through even a full closing motion. The hand is often half-closed to begin the exercise, in order to hold the device.

The finger extensor muscles (as we have discussed ad nauseam) are contracting statically to support the finger flexor action during grip. Again, no functional range of movement occurs, only static contraction. Little or no movement means *little or no blood flow* being stimulated to and away from the muscles, tendons, and joint surfaces (cartilage) of the elbow, and upper extremity in general.

True, the finger closing muscles are contracting to grip the item, so *some* muscle contraction (i.e., isometric contraction) evokes *some* blood flow response. But the response is not near as strong if compared to the hands actively moving through full ranges of natural opening and closing with resistance (i.e., isotonic contraction).

There is an exercise physiology phrase *'functional exercise hyperemia,'* which means that the body increases blood flow when, where and to what degree an area is commonly exercised.

I often use shoulder motion to illustrate blood flow in relation to exercise. If I move my arm through a small range of motion (i.e., rock my arm at waist level), compared to moving my arm through a full

ROM (i.e., a windmill motion), which exercise would stimulate more blood flow?

The full ROM shoulder exercise, of course. This is an over-simplification, yes, but it allows people to intuitively understand *functional exercise hyperemia*. Move it or lose it is a similar concept. Wolff's Law describes a parallel adaptive concept whereby bone structure reacts to the specific functional demands of the body area.

In other words, the body is super-smart! It adapts to what you do. It adapts to *your environment*.

Do you think closing your hand against resistance compared to closing AND opening your hand against resistance would produce any difference in your body according to the principle of functional exercise hyperemia? Turns out it does.

In October of 2017, common 'squeeze-only' grip device approaches were compared to the Handmaster Plus exercise. Thermograph pictures were taken one minute after one minute of exercise using each device. The Handmaster Plus exercise was superior to 'squeeze-only' devices for stimulating circulation.

Indeed, one of the main benefits of proper, full ROM hand and grip exercise is better circulation, thus a better supply of oxygen and nutrients (via the arterial blood) to the muscles, tendons, and joint surfaces of the elbow, and more efficient drainage of waste products away (via venous blood and lymphatic drainage).

Better circulation means healthier tissues. And better circulation also means healthy elbows. Healthy elbows perform better and are much more difficult to injure.

Repetitive grip alone creates a circulation dilemma at the elbow.

Let's now consider what happens when we add stressful motion AND repetitive gripping to challenge the health and fitness of the elbow? Readers, we are just getting started… and these stressors of the elbow having been hiding in plain site for far too long.

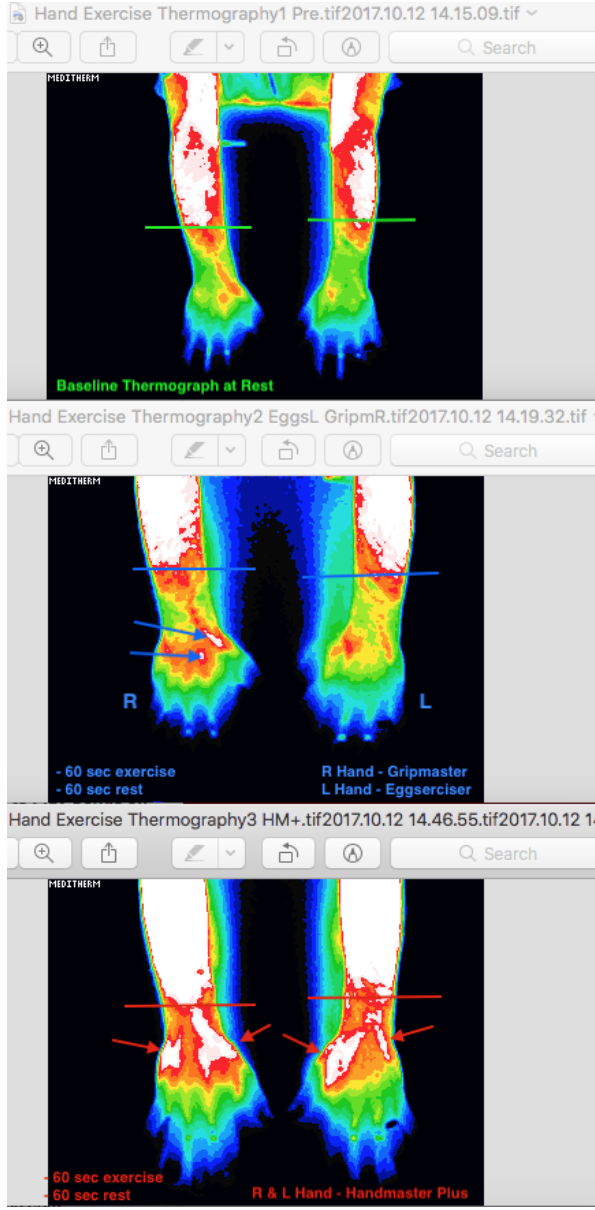


Fig. 17 Thermography Test: Resting vs. Squeeze-Only vs. Handmaster Plus After One Minute of Exercise

Chapter 5B
Grip Dilemmas at the Elbow (Active)

There are 4 more grip dilemmas at the elbow remaining. Stay with me, as I believe you will find these final 4 especially fascinating and very familiar. These dilemmas at the elbow are the result of grip PLUS a stressful motion. Thus, I refer to them as active grip dilemmas at the elbow.

The examples of active grip dilemmas at the elbow are everywhere and are directly causing diverse & costly elbow injuries. Elbow instability is thus especially common in sports, music, hobby, gaming, computers, and in the workplace. The author does not understand how the active elbow dilemmas to follow can each be considered *new material,* but they are.

Currently, it's true… repetitive grip has been mostly overlooked, and rarely mentioned. Yet people continue to repetitively grip every day without a thought, both in their daily routines and in their fitness training routines.

We can surmise from the first 3 grip dilemmas at the elbow that when an individual has been repetitively gripping in training or simply in performing their given daily activity (or both), the tissues of the elbow (ligament, tendon, muscle & fascia) are *already* shortened and *already* have poor blood flow. They are also *already* at high risk for injury*,* and are *already* performing well below capacity, even if one is generally asymptomatic.

Keep in mind that whenever any joint, muscle, tendon, or general body area is prepared poorly for activity, and then in turn exposed to the stressors of real-world performance or competition, the results are predictable: weakness > poor performance > nuisance > breakdown> Injury.

A simple progression. And no one is immune to the laws of Nature.

Think of poor spinal posture again, for example. A person with poor posture feels normal, gets weaker, performs at a lower level, feels stiff, gets sore, and then, boom!… is debilitated.

Repetitive gripping is not unlike poor posture (in fact, *VERY similar*).

The elbows are subsequently exposed to injury due to repetitive gripping, just the same way the low back is exposed to injury because of poor posture. *Both scenarios create a primary imbalance and secondary mechanical stressors.*

There are 4 different and specific types of 'active elbow stress' that are notable in sports, music, hobby, gaming, computers and in the workplace. Once understood, the correlation between complete hand muscle training and elbow health and performance becomes *crystal clear*.

So, what happens when we add the stressors of grip *and* active performance to the elbow? Let's look at 4 common scenarios and realize that balanced grip training and hand muscle health is essential in order to maximize performance and prevent injury.

Fig. 19 Tennis Serve - Elbow Stress Fig. 18 Golf Shot - Elbow Stress

Dilemma #4 (Active) – Grip & Strike

Golf, tennis (i.e. all racquet sports), and hockey are three prime examples of additional stress being placed on elbows during a grip & strike motion, but there are many others.

Chefs, butchers & drummers also share this dilemma. For explanation sake, let's stick to familiar sports to create easier visual examples in our minds.

Think first of contact during a golf shot (i.e., club, ball & ground) or a slap shot in hockey (i.e., stick, puck & ice). The *inside* elbow of the trailing arm (i.e., the right arm for right-handers, left arm for left-handers) is placed in great stress at the moment of contact. The same is true for the *inside* elbow of a tennis player during the strike of a serve or forehand stroke. All place the elbow at substantial stress.

Why? Because of the *'grip & strike'* grip dilemma. The grip muscles are actively engaged in grip at peak output when the strike force to the elbow is at its peak challenge. Muscle *con*-traction and forceful *dis*-traction occur *at the same moment*.

Something has to give, eventually. Over time, it will be the elbow tissues, the muscles, tendons and/or ligaments if the area is not well understood and trained maximally. Micro-traumas add up to weakness at the least and instability and injury in many cases.

Using surface electromyography (sEMG), we can illustrate that grip pressure is at its highest during the actual strike in '*grip & strike'* scenarios.

The main finger flexor muscles (which cross the *inside* of the elbow) are fully engaged in grip (see peaks in Fig. 20 Hockey Slap Shots pattern) *AND* most fully exposed to the greatest strike force… *at the same time*.

The same is true for the Golf Driver Shot muscle pattern shown in Fig. 21. Grip muscles contract at highest force when strike force to the elbow is highest.

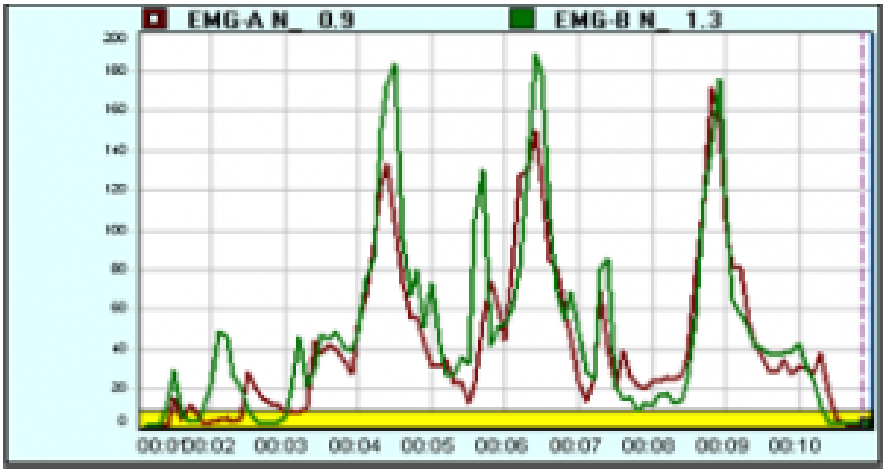


Fig. 20 Hockey Slap Shots – Muscle Pattern

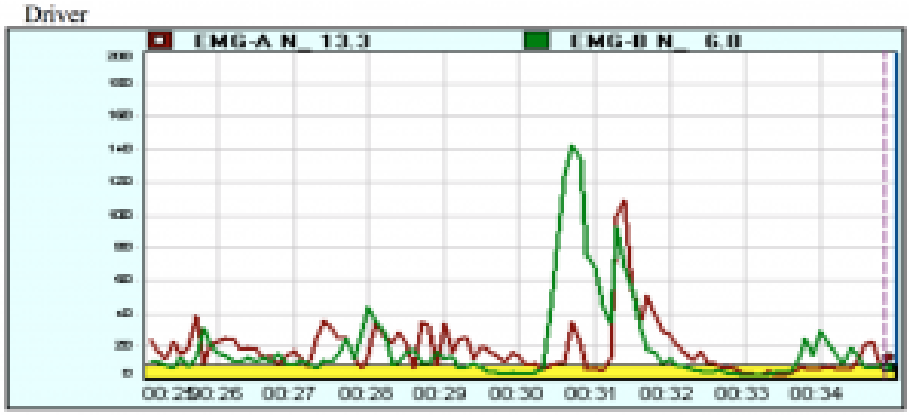


Fig. 21 Golf Driver Shot - Muscle Pattern

This is a serious dilemma to the inside or medial (i.e., flexor) side of the elbow, exposing it to regular repetitive micro- and macro-trauma stress of the elbow's flexor tendons, muscles and ligaments. Micro- and macro-tearing can be both unnoticeable and noticeable.

Advanced ligament damage can be the result in more extreme situations (i.e. accidental tree root contact in golf) and more chronic

cases (i.e. chronic tendon injury in professional golf, hockey, tennis athlete, etc.) at both the elbow and the wrist.

In all of these cases, the athlete must know that it is *essential* to prepare their hand muscles properly (i.e., for strength, balance & circulation) to mitigate injury exposure due to this chronic *grip & strike* risk.

Let's also seriously examine the *outside* elbow of the *lead arm* in golf and hockey (i.e. the left arm of a right-hander, right arm of a left-hander), and the *outside* elbow of the *dominant arm* during a backhand stroke in tennis.

During the ball or puck strike (Fig. 22), the main finger extensor muscles (i.e., that cross the outside or 'lateral' elbow) are most fully engaged in grip *AND* most fully exposed to strike force, again, *at the same time.* Each strike applies considerable stress to the already contracted and engaged outside elbow tendons.

Just as a guitar string is easier to cut or snap when it is over-tight, muscles & tendons are more easily torn or injured when chronically tight, shortened and inflexible.

'Grip & strike' actions *on their own* place stress at the elbow, but that risk is amplified exponentially when the tendons of the hand muscles that affect the elbow have been chronically shortened, made static, and/or are lacking healthy blood flow from decades of gripping and/or 'squeeze-only' dominated hand exercise.

Attention to detail must be made to be the highest priority when training the grip of anyone who regularly and inherently exposes his or her elbows to regular *'grip & strike'* scenarios.

The 9 muscles that open the hand and the 9 muscles that close the hand must be strong, healthy and balanced in order to accommodate this regular and active repetitive stress.

Dilemma #5 (Active) – Grip & Stretch

The remainder of the elbow grip dilemma explanations (5-7) may be somewhat easier to comprehend now that '*grip & strike'* has been discussed.

A new mindset is required in order to clearly see these active grip dilemmas for what they are.

Fig. 22 Hockey slap shot creates stress at outside lead elbow

It is the author's opinion that we, as therapists and trainers, as well as athletes, musicians, workers and lay people, have been hypnotized by superficial injury titles (tennis elbow, golfer's elbow, cubital tunnel syndrome, etc.) and we pass over the deeper *cause* of the condition completely. We don't always question the mechanics of the injury. Instead, we focus on the seemingly *obvious* labeled name and symptom(s). Yet, there is always a sensible underlying *cause* to be learned.

The best examples of the *'grip & stretch'* type elbow stress are in throwers. We've all heard terms like *thrower's elbow*, *little league*

elbow and *javelin elbow*. These are throwing motions that create an inherent conflict between 'grip' and 'separation', two actions that are opposing.

Throwing motions create a very dangerous *valgus stress (i.e. an angled joint separation outward)* risk for tendon and ligament injuries at the medial elbow. The elbow is essentially *tractioned* by the stretch of the throwing force while at the same time being contracted by the gripping action of the fingers.

These actions essentially oppose one another until the release of the ball or javelin, in these examples. It's a tug of war at the elbow before the release.

Fig. 23 Valgus stress at baseball thrower's elbow

Fig. 24 Grip & stretch in gymnastics rings

This *'grip & stretch'* exists in other instances without the release of the gripped item. Examples are gymnastics (i.e. grips, bars, rings), climbing and football tackling. Each can create stressful elbow moments that bring a great risk of injury. The finger muscles contract across the elbow while the joint is being stretched.

When hand muscles are trained improperly or are not trained at all (i.e. most athletes in *'grip & stretch'* sports regularly train forearms, biceps, triceps, shoulders, chest, back, and torso… often requiring clenched grip to create resistance), the result is unopposed hand muscle imbalance and shortened tendons at the medial elbow.

Traction spurs can occur at the elbow when inflammation and elbow stress is chronic. It's the body's wise way of stabilizing this unstable situation. But we should do our best, in advance, to prepare these elbows suitably for these inherent stressors by developing balanced hand, wrist and forearm muscles and tendons.

'Grip and stretch' also occurs in the follow through in sports such as tennis, golf, hockey and lacrosse. In this case, the racquet, club or stick releases to the target while still being held. This moment of stress occurs at the outside elbow as the finger extensor muscles contracts while the racquet, club or stick releases.

A further *stretch dilemma* occurs upon full release of a thrown item. The momentum of the baseball, javelin, football, cricket ball, or even the dart thrown chronically again and again creates a full follow-through *release* stress (stretch) at the lateral elbow.

This *release dilemma* is not a classic active grip dilemma. Instead, it results when the muscles and tendons involved in the kinetic chain of grip are chronically shortened or injured from repetitive gripping and/or weight training. The outside lateral elbow must be healthy and flexible to allow the hands and wrist to safety release the item, and avoid injury.

Ben Roethlisberger's injury in the 2019/2020 Pittsburgh Steeler season is likely representative of this type of release dilemma.

The lateral elbow must be fully prepared and healthy to give throwing athletes the best chance for stability during release.

The Figure 8 Exercise in Chapter 9 is recommended for all throwing athletes to prepare the elbow for these very challenging demands.

Throwers face the potential for trouble everywhere; before the throw (i.e., static gripping in training), during the throw (*grip & stretch*), and after the throw (*release dilemma*). They MUST be trained properly at the hand, wrist, forearm and elbow. They must be in balance. They must be flexible. They must have healthy blood flow to the elbow-related muscles, tendons and ligaments at the inside and outside of the elbow.

Otherwise, the results are predictable.

Dilemma #6 (Active) – Grip & Rotate

Grip dilemma #6 at the elbow is *'grip & rotate'*. Let's again first offer some examples and next examine the problem.

Activity types which require active grip plus rotation are automobile & autobody mechanics, heavy duty mechanics, plumbers, painters, motorcyclists, jet-skiers, motocross, table tennis and tennis

(spin hitters), assembly line (if twisting), check out cashiers in grocery stores, etc. These are common activities where gripping an item and rotating the wrist and/or forearm are combined.

Fig. 25 Baseball release creates stress at the outside elbow

Here we see a unique elbow stress. The individual will seem healthy, even strong, and then suddenly become quite debilitated with elbow pain laterally or medially.

The finger muscles and tendons (both extensors and flexors) are chronically engaged in repetitive grip, which we know causes unhealthy shortening and poor blood flow at the inside (due to shortening of the finger and wrist flexor muscles) and outside (due to chronic static contraction of the finger and wrist extensor muscles in gripping) of the elbow. To that, add in that the individual is trying to create some type of rotation at a wrist or at an elbow that isn't (via habitual repetitive gripping) able to move maximally. *Rotation* in these terms could mean flexion and/or extension at the wrist, ulnar or radial deviation at the wrist, or pronation or supination of the forearm, or a combination of all.

Supinator muscles that attach at the lateral epicondyle of the humerus as well as at the forearm become shortened when forearm rotational tasks are habitually outward (external forearm rotation). Pronator muscles attach above the medial epicondyle and at the forearm and become shortened when forearm rotational tasks are habitually inward (internal forearm rotation).

Grip & rotation isn't a strike force dilemma, but instead a chronic request for the elbow to perform rotation at the same time the finger flexor and extensor muscles (that cross the elbow) are contracting. Another dilemma. The elbow is being asked to *move and not move* at the same time.

The elbow's soft tissue structures are littered with chronic imbalances in these *'grip & rotate'* activities.

For example, the motocross athlete would repetitively grasp, flex and extend the wrist AND rotate in order to throttle the bike. The auto mechanic would grip (i.e. wrench or screwdriver) and twist, often with great pressure, to loosen or tighten a bolt or screw. The grocery cashier grips and rotates repetitively to swipe bar codes, plus grips and rotates further to place items in bags.

We have worked with a world-class jet-skier to re-establish strength, balance and blood flow at the hand, wrist, carpal tunnel and elbow in order for him to return to his sport. If left alone, the imbalance does not clear. Balance must be understood as the

continuous focus because grip activities draw the participant away from balance.

Fig. 26 Grip & rotation elbow imbalances are common in motocross

Forceful and chronic repetitive *rotation* against an elbow that is progressively immobilized because of static finger muscles becomes a dilemma. The imbalance factors of *'grip & rotate'* must be understood, and the elbow must be suitably trained for stability, balance, flexibility and blood flow.

Properly balanced grip training is vital for these individuals – as all other active grip situations – even though they may seem strong for a long time. Optimum balance, stability and blood flow at the hand, wrist, carpal tunnel, forearm and elbow should always be the goal with *'grip & rotate'* individuals.

Once the elbow imbalance is chronic, trouble is around the corner.

Dilemma #7 (Active) – Grip & Repetition

If you are following well so far, way to go.

These elbow grip dilemmas are new perspectives for most, even advanced trainers and therapists. They are information for deliberation, but they have been witnessed again and again in surface electromyography muscle pattern testing and in analyzing injuries.

The goal in this chapter is two-fold: 1) To illustrate how greatly our elbows are challenged in an array of activities, and 2) to observe how poorly our elbows are prepared or even considered when training. Elbow performance is front and center in most of our daily lives. We must begin to take it seriously.

Sometimes it takes time to learn a new perspective and create a new room in our brain to store that new perspective. Please process each of these concepts yourself and see if it makes sense within your activities and/or expertise.

New ideas such as *simple full range of motion hand exercise* may have difficult births, even if sensible. Grip training principles and hand muscle balance must be understood deeply if we intend to create solutions and have strong, stable, healthy elbows.

And now we examine a problem with which most reader can relate. Like *'grip & rotate,'* this type of active grip dilemma is insidious until it is obvious. Until it is causing problems, it is usually disregarded.

The final main elbow dilemma is *'Grip & Repetition'* and is probably inherent as a factor in all other grip dilemmas and all other imbalance conditions. It is a bit of a catchall, yet requires attention on its own category because of its insidious nature. There is no dramatic force to describe to define its signature. It is a slow build, a daily subtle stray from neutral that suddenly, one day, becomes a *commonly diagnosed condition*.

In the *'grip & repetition'* dilemma, the stress action is cumulative, usually without an event that sets it off. 'I was just doing __ and I suddenly felt the problem, __' Is the common history. To view these *'grip & repetition' problems* from a causative prospective

helps us realize that no imbalance *just happens.* All imbalances have a cause to be learned and addressed.

Two examples to offer in an effort to illustrate this dilemma are musicians and workplace injuries. For the purpose of illustration, I will specifically use guitar players (as musicians) and dental hygienists (as workplace injuries). These are two of most chronically debilitating subtle repetition activities I've been involved with and studied.

Guitar & music stores are still filled with default *'squeeze-only'* grippers, whether spring-loaded, coiled or rings. They are still very popular. But a repetitive grip item will never solve a repetitive grip problem.

The music merchandise marketplace (like all marketplaces) cares about what sells, and these 'squeeze-only' items still sell. They sell because of an archaic customer belief about the mechanics of grip, finger and hand strength, and speed training. The belief again is that only the *squeeze* muscles are at work in making grip. We know already that the story is much more detailed.

On the surface, 'squeeze-only' devices appear to work well because the user feels (*and is*) stronger and faster in the short term, the same way a young boy is stronger when he strengthens his chest and biceps muscle groups to impress the girls, yet forgets to (or does not know to) train his back and triceps muscle groups, in order to attain strength, stability *and* balance.

Eventually, all imbalanced training approaches show weakness. Slowly. Subtly. The body can only absorb only so much imbalance before there is a tipping point towards instability, breakdown and injury.

The author has worked directly with many musicians, including famous and accomplished bands. One guitarist of a Rock and Roll Hall of Famer was riddled with hand arthritis, very common in older guitar players. One Grand Ole Opry member bassist struggled with circulation and resultant cramping, especially during long

performances. Music injuries are rampant. Nearly all can be linked to repetition.

Repetition injuries are very common in musicians, especially as they age and are unaware of muscle and joint balance and blood flow principles.

If repetitive gripping worked well, career musicians would be in wonderful physical shape. But, mostly, they are not. The older they get, the more these imbalances add up and symptoms worsen. Their discomforts *must* serve to educate the next generation of musicians. Health and wellness professionals must come to their aid with both education and training.

Most often, musicians turn to pharmaceutical drugs to numb the pain, drugs that have nothing to do with what is causing the situation. It is ludicrous and shortsighted, but is the norm. Ask an old musician. And most sadly of all, nothing is learned then from their struggle.

On the other end, when musicians are young, their body adapts much better and these imbalances, though absolutely present, remain asymptomatic. Young musicians often shrug suggestions of a serious imbalance problem. They don't know how strong, fast and stable they *could be* because they don't hurt, or don't hurt enough.

Our society has been taught: 'If it ain't hurtin', don't fix it.' The imbalances are all under the radar and can only be illustrated by poking, pain point mapping and muscle testing.

I teach: 'If it's worth doing, it's worth doing well.' Be your best. Perform at your maximum. Don't come close to where your body might invite symptoms. Understand deeply the greatest instrument you will ever have. You.

The most important instrument a musician will ever have is *themselves.* Musicians must learn to train grip well. It is inherent in their craft and vital to their health and their performance.

The music market is in need of health and fitness education and leadership. Musicians are in need of balance, stability and optimum function. And the world needs music.

At the elbow, *'grip & repetition'* riddles most every guitarist with subtle and not so subtle imbalance conditions. *Tennis elbow (lateral epicondylitis)* is ultra-common and is almost a given for accomplished guitarists. *Medial epicondylitis* is also common because of unopposed repetitive wrist and finger flexion.

Cubital tunnel syndrome is a lesser-known but common condition among guitarists that occurs at the inside and back of the elbow. Cubital tunnel syndrome is a prime example of a *'grip & repetition'* elbow dilemma. The combination of repetitive shoulder abduction, elbow, wrist, and finger flexion, plus forearm rotation of the fretting hand leads to a habitual decrease in the height of the cubital tunnel. This change in space interferes with the passage of the ulnar nerve, causing weakness, numbness, and pain. The nerve can become trapped under a chronically shortened FCU (flexor carpi ulnaris) muscle, which flexes the wrist toward the medial elbow.

Fig. 27 'Cubital tunnel syndrome' common in guitarists due to 'Grip & repetition'

Cubital tunnel syndrome can incapacitate a guitar player.

The musician must effort to understand these imbalances and effort to offset the repetitive nature of their pursuit in order to maintain the healthy balance of the hand, wrist and forearm muscles. To do so requires educational leadership by trainers and health care providers, as well as a regular, disciplined, balanced training commitment from musicians.

The musician must understand the role of the 9 muscles that open the hand, the 9 muscles that close the hand, and the 9 forearm muscles that support the hand in place during performance.

After this long-winded explanation, it is 2 simple exercises that any musician can easily and conveniently perform to offset these imbalances. Refer to Chapter 9 to see our main HO/HC & Figure 8 Exercises.

Workplaces around the world are also strewn with *'Grip & Repetition'* dilemmas at the elbow, no more so than in the dental field, especially *dental hygienists.*

Dental hygienists face: 1) dental tools that are small in nature (creating increased hand muscle output for grip), 2) dental tools that are often vibrating (increasing grip demand), 3) gripping for long periods without a break, and 4) working in a mostly *palm-down* position (creating additional stress to finger and wrist extensor muscles).

The *palm-down* gripping position, as described previously, places a 'double-stress' on the finger and wrist extensor muscles of dental hygienists, because: 1) they contract to support the finger flexor muscles, and 2) they contract to hold the fingers and wrist up against gravity.

As a result, dental hygienists are subject to chronic, debilitating *'Grip & Repetition'* elbow imbalance conditions. Tennis elbow is the most common chronic elbow condition seen in dental hygienists, as well as in all dental profession. C

Fig. 28 Grip & Repetition – Dental Hygienist

Carpal tunnel syndrome is another RSI that strikes down dental professionals and is likely related directly to the breakdown of the *kinetic chain of grip*.

Grip principles and ergonomic stability exercises should be presented to all dental hygienists during their training. None are immune to this dilemma at the elbow. Two simple exercises are recommended for dentists, dental hygienist s, and dental assistants to utilize in an effort to maintain healthy balance, maximize performance and prevent injury. Refer to Chapter 9 (HC/HO & Figure 8 Exercise).

Of course, *grip & repetition* exists in so many other occupations, sports, musical pursuits, and in gaming, cell phone use, computers and hobby. It is somewhat of a catchall. Hand muscle training and balance is still a new idea that has vast applications to the health and performance of so many, nearly all in fact. To be attentive to grip and hand muscle strength, balance and circulation at all times is a needed awareness.

In our modern society, elbow dilemmas are nearly everywhere because repetitive gripping habits are nearly everywhere. Our first step is to understand the mechanics that cause these elbow dilemmas. The next step is to take them seriously. Only then can we affect the final step, which is a widespread change. By reading this book you are well ahead of understanding how to set the goal of keeping your hands, wrists, forearms, and elbows healthy for a lifetime.

I am hopeful now that you will recognize the various active grip dilemmas at the elbow and recognize where *grip & strike, grip & stretch, grip & rotation,* and *grip & repetition* are at play, and effort to understand and prepare properly for these activities in your own life.

Only then can we hope to perform maximally and make rampant elbow injury a thing of the past.

Your in-depth time and effort spent at learning about the elbow now pays off in spades. In Chapter 6, we address why most grip dilemmas at the elbow also affect the stability and performance of the wrist and forearm.

Chapter 6
The Wrist & Forearm

Turning our attention to the wrist and forearm will give us yet another opportunity to examine the importance of the grip and grip stabilizing muscles.

In any situation where the elbow has been placed under the stress of imbalance due to repetitive gripping, so has the wrist and forearm.

Historically, health and fitness leaders have perceived elbow, forearm, wrist, carpal tunnel, hand, finger, and thumb injuries as being separate. This entire area truly works as one. Thus, imbalances occur as one and breakdown occurs as one. We must become aware of this mechanical relationship in order to change our beliefs about our hands and our grip. The *kinetic chain of grip* connects all.

Throughout the rest of the book, you may also learn that Great Hands can affect general health and longevity. Has that idea ever crossed your mind? Many surprises are yet to come.

You will never see an imbalanced wrist coupled with a balanced forearm and elbow. All are dependent on the balance of the hand, grip and grip support muscles.

Weakness and injury to the wrist and forearm are, as we have come to expect, largely due underlying muscle imbalance, poor flexibility and/or poor blood flow.

Golfers, tennis players, and hockey players create stress at the wrist when chronically shortened finger and wrist tendons are challenged during each strike, exactly similar to the many dilemmas at the elbow.

People that grip and perform small range of motion wrist actions daily may isolate the wrist and increase the risk of chronic tendon and

ligament injury. If striking, stretch, rotation or repetition are added, that risk becomes exponential.

Proper understanding of hand and grip training is vital when it comes to the performance of the important wrist and forearm. The wrist and forearm are crucial in creating strong positions of support for actions of the hand, especially actions involving grip. If you desire Great Hands, you must have great wrists and forearms.

Recall in Chapter 3, How Grip Works, we talked about the study by ZM Li that illustrates how the wrist and forearm attempt to find a position of stability that best supports the grip. Li et al. found that mean angle to be 20° of extension and 5° of ulnar deviation in an ideal clinical situation.

Our wrist and forearm muscles are clearly actively engaged to innately find the best position to perform the grip task at hand. We are not always gripping in an ideal situation, so we must prepare the wrists and forearms to support grip in any situation.

The wrist and forearm participate in creating 3 distinct modes of movement to participate in grip and upper extremity action:

1. Flexion and extension (or wrist bending)
2. Abduction and adduction (or wrist deviation)
3. Pronation and supination (or forearm rotation)

When training the wrists and forearms, most detailed health and fitness professionals address these 3 motions distinct and separate, performing exercises for each motion.

The author originally train athletes and patients the same way (i.e., weighted item through each separate wrist and forearm motions), but I eventually found these limits:

1. Time consuming for the athlete or patient,
2. Does not support true 3-dimensional ranges of motion,

3. Does not prepare an athlete for real activity.

In about 2013, I started using Handmaster Plus to train wrists, forearms and elbows in a whole new way. I had commonly seen wrist imbalance, as well as tendonosis (thickening of the tendons) and overuse resulting in ligament problems in golfers and hockey players specifically.

I had previously developed a way to train all of the 18 hand muscles through full, natural, 3-dimensional ranges of motion in developing Handmaster Plus. I now needed to use that same thinking to devise an exercise to train the 9 supportive wrist and forearm muscles properly while avoiding elbow dilemmas. This could not be accomplished while gripping a weight (i.e. grip dilemma #1 - static finger muscles).

This was the genesis of the 'Figure 8 Exercise' that is used today, and displayed prominently in Chapter 9. This exercise is highly recommended for training individuals who are dependent on advanced grip health and performance.

In the Figure 8 Exercise, the hand is 1) closed fully, 2) then opened fully and 3) then while the hand is open, the wrist is moved through it's full figure 8 motion. The user repeats until comfortable fatigue. The first 2 steps strengthen and balance the 18 hand muscles. The figure 8 motion naturally combines all 3 wrist and forearm planes of motion. The hand is open while performing the figure 8, so there is no 'dilemma' at the elbow..

The Figure 8 exercise is a complete and super convenient exercise for training the entire kinetic chain of grip,

In reality, we must understand that real wrist and forearm actions do not occur in separated motions. The wrist and forearm are always moving in 3-dimensions in an effort to grip an item and completing an intended task.

We must also remember that most jobs and activities demand the same repetitive small ranges of grip actions daily and chronically.

This can lead quickly to imbalance, overuse, tendonitis (inflammation), tendonosis (thickening) and injury.

For example, the guitar player is gripping the strings of the guitar AND maneuvering his or her wrist and forearm to allow the fingers to make cords or create a given outcome. That may require flexing, extending, deviating, and/or rotating the wrist while still gripping, all while playing the same song. Guitarists practise and perform day after day, and night after night.

The cashier is gripping a can of beans, then a bag of grapes then a greeting card, as well as scanning the barcode of each. All occurs repetitively through a small range of motion, shift after shift, day after day.

The surgeon grips a small scalpel in a palm-down hand position and uses very small ranges of finger, thumb, hand, and wrist motion to delicately and accurately perform her or his craft. Hour by hour, day in and day out. Same small motions.

Each example has THE SAME requirements to their continued health and performance: Each must ensure that all muscles of the *kinetic chain of grip* are trained fully through natural ranges of motion. The resultant strength, balance and circulation prepares each user for maximum hand and grip performance.

The Figure 8 Exercise connects the hand with the wrist and forearm, making the path to Great Hands even more convenient.

CHAPTER 7
THE CARPAL TUNNEL

As much as my observations of imbalances and injuries at the elbow, forearm and wrist were central to my entry into exploring and understanding the proper training of the hand muscles, *the carpal tunnel got me hooked.*

The carpal tunnel is a fascinating area. It is also an area that most shy away from. Most do not spend the time and attention needed to gain a deep understanding of the carpal tunnel structure and its function. Most all information available to the public whether written, spoken and/or blogged regarding the carpal tunnel is unwaveringly superficial. A quick search engine search is not enough to know it. The author 20 years in and still learning.

To the layperson, talk of the carpal tunnel does not generally elicit an enticing response. Whenever most folks hear the term 'carpal tunnel' it is usually followed by the word 'syndrome.' Thus, when one does hear of it, they, or someone they one know and love, is experiencing pain, weakness, numbness and/or debilitation. Yes, when most think of the carpal tunnel, it is likely in relation to facing the feared prospect of *surgery*. Ouch. Not a comfortable midday tea conversation.

And carpal tunnel syndrome is a very real problem in our world, especially in the workplace. According to the US Department of Labor, days lost from work due to carpal tunnel syndrome is usually in second place (27), lead only by the 30 days of work lost due to fractures [7]. To gain additional perspective, in third place are amputations at 21 days of work lost. Double Ouch. Serious stuff.

The average direct cost of a carpal tunnel workplace injury to employers, according to OSHA's Safety Pays Program, is $28,647 per employee. Carpal tunnel injuries also mean a loss of income for the worker themselves in the long term.

When health and fitness experts focus attention on the carpal tunnel, it is usually because the carpal tunnel of a patient or client has *already* broken down in some way. They are usually treating carpal tunnel syndrome. They are treating symptoms, not necessarily addressing the needs of the carpal tunnel as a whole structure.

I have learned over the last two decades that there are many holes in the story that most health and fitness experts were taught. I'm not trying to be critical or cynical here. I was one of those practitioners. *I missed a lot.* Patients entering practitioner doors are concerned about many intricate body areas. It's hard to know it all, especially in detail.

We (healthcare practitioners) take seminars and learn carpal tunnel syndrome treatment protocols and techniques that eventually become close to cookbook-like, clockwork treatments; and these approaches work to some extent or they wouldn't be around. But we've never been acute in our exploration of this carpal tunnel, what it is, how it works, how it is supported, *why* it breaks down, and what we can do to make it *thrive*. Yes, thrive. I believe the carpal tunnel can *thrive*.

Again the author defaults to the reminder that we must all begin to focus on making the body thrive as a target goal. We need to maximize our stability and function and make ourselves the best that we can be – always – as a goal. That's why I use the term *Great Hands*, not *okay hands*.

How do we create maximum performance in these structures that we depend on daily? We need to get our mindsets away from symptom-focused concerns and switch to maintaining maximum structural stability so that, at any time, the appearance of any symptom would seem unusual, or at least highly unlikely.

We must have simple and sensible daily habits that support maximum strength, balance and circulation throughout our body. So many of us are in a teetering state at the edge of sub-acute weakness and imbalance, just waiting for that final straw to break the camel's back. It's not good enough. We can do MUCH better. We must do MUCH better.

Outcomes are rarely isolated. They come as a result of the environment that *we* create. And it's the environment *we* must understand. To do so, we must focus deeply on the body or the body area, in this case the carpal tunnel. The bonus is that once we focus on one body area and learn it, we automatically learn much of the nuts and bolts of other areas because the body is quite consistent.

The carpal tunnel has never been looked at with *awe or wonder as* it should be. The author hopes to change that now.

In essence, let's shine light on this structure. Let's not shy away from the carpet tunnel. As with *anything (life note!)*, the only way to understand something is to care about it and learn about it deeply. Only then can we properly understand and prepare the carpal tunnel properly and support it for the tasks we ask it to become a part of. Only then can we have a proper conversation about how to train it best. The carpal tunnel breaks down because we don't understand it and we treat it poorly. It's easy to care for it once we care about it.

Another reason to take interest in the carpal tunnel is that it is indeed part and parcel of the larger balance of the finger, thumb, hand, wrist, forearm and elbow complex. To learn how to manage one will help us to manage the rest of this tricky complex. It is indeed inter-related to the wide-reaching concept of poor hand muscle posture. If we simply 'cover-up' the problems that cause carpal tunnel syndrome, we ignore the body's signal for attention and leave the rest of complex imbalanced, unhealthy and at risk of injury.

I often pause to try to think of what Nature had to consider when creating this structure, the carpel tunnel, because it is truly fascinating. Such a structure is been largely overlooked for our entire history. Left to history, the carpal tunnel is seen as a creaky, faulty space that experiences uncontrollable breakdowns. We never speak of *training the carpal tunnel.*

So what is the carpal tunnel? There are SO many references, blogs and websites that explain the structure of carpal tunnel, but few that take a shot at rendering an opinion at the cause or even the suspicion of its breakdown. Few go into the detail needed to attempt

to understand it. I'll spend one wordy paragraph on its general structure…

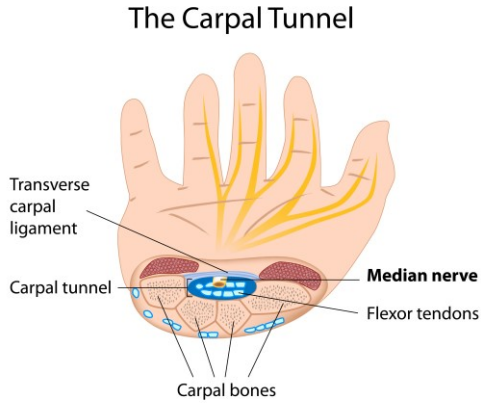


Fig. 29 Anatomy

The carpal tunnel is a true tunnel, an *osteofibrous canal* (*osteo* meaning bone & *fibrous* referring to connective tissue) bordered by carpal (wrist) bones below (dorsally), bordered also by carpal bones on both sides, and topped (ventrally) by the transverse carpal ligament (also called the 'flexor retinaculum' (Note: why do some structures have multiple names? Is it like having a *nickname?*)) which is located just under your palm side skin. Thus, wrist bones make the floor and sides of the tunnel, the sides formed specifically by the trapezium and scaphoid bones on the thumb side border (i.e., the lateral side) and the pisiform and hamate (the hook of the hamate) bones forming the pinky side border (i.e., the medial side). Through the tunnel passes 9 flexor tendons and their sheaths, 1 key nerve (the medial nerve), connective tissue and fluid. Of the 9 flexor tendons, 4 are deep finger flexor tendons, and 4 are superficial finger flexor tendons that all share the same sheath. The final passing tendon is the long flexor tendon of the thumb, which has its own sheath. Whew. A mouthful. Reread as needed.

Carpal tunnel syndrome (CTS) is estimated to affect 3% to 6% of US adults, with 3 times as many women affected as men.[89]

Carpal tunnel release (CTR) surgeries are the most common hand and wrist surgery in the USA with over 400,000 procedures performed annually, carrying a social and economic cost that exceeds $2 billion USD.[10]

CTS is ultimately the result of pressure on the median nerve within the carpal tunnel.

Then the question is, what causes the pressure on the median nerve?

The carpal tunnel is an example of a structure that is secondarily affected by the core imbalance created by daily repetitive gripping, without the opposition of *proper structural exercise*. From my experience, the carpal tunnel is especially vulnerable to the repetitive gripping of smaller items, but I have never found evidence or discussion as such in the literature to support my anecdotal observations. The tunnel also appears to be more vulnerable to the author when the wrist is commonly held in a flexed position.

Other scenarios where carpal tunnel syndrome is generally accepted as common are in circumstances of poor circulation (i.e., pregnancy, diabetes, obesity, kidney failure, etc.), inflammation (i.e., arthritis, Rheumatoid arthritis, sprain, etc.) and in traumatic injury to the wrist structure itself (i.e., wrist fracture, dislocation, subluxation, etc). Women are more likely than men to develop carpal tunnel syndrome, as previously noted. All at-risk populations are important to take note of as they provide hints as to the physical challenges on the tunnel which may, in turn, help us to keep it stable.

There are three main issues to monitor to evaluate the stability of the carpal tunnel:

1. Space
2. Shape
3. Internal Pressure

To understand the vulnerabilities of the carpal tunnel, let's review a bit of muscle anatomy from Chapter 2 and consider more specifically what repetitive contraction of these muscles can possibly do to the carpal tunnel itself.

Note first (from Chapter 2) that there are 4 small intrinsic hand muscles that close the hand which originate *directly from* the transverse carpal ligament (TCL), the vital roof of the tunnel:

a. 2 pinky finger muscles – *flexor digiti minimi* & *opponens digiti minimi*

b. 2 thumb muscles – *flexor opponens pollicus* & *opponens pollicus*

These 4 muscles often work in combination, especially when gripping smaller items. If the gripping is repetitive, the author hypothesizes that overuse can cause swelling and resultant chronic thickening of the TCL (i.e., the attachment of the 4 muscles), thus compromising the vitality and space of the carpal tunnel. Less space and increased tunnel pressure create a very reasonable environment for median nerve pressure. Though a possible explanation of CTS cause, it should be pointed out clearly that this hypothesis is thus far unproven by research. That said, if your daily habits involve gripping, especially of smaller items, please be aware.

Indeed there is much attention focused on the key roof structure of the carpal tunnel, the TCL, as it is a common focus in carpal tunnel syndrome. The TCL is about 3–4 cm wide and inserts into the scaphoid and pisiform bones at the start (proximal portion) of the tunnel and into the trapezium and hamate (hook of the hamate) at the end (distal portion) of the tunnel. On the radial (or thumb) side it divides into two layers to accommodate the tendon of the flexor carpi radialis (FCR), one of the 3 main wrist flexor tendons. Another wrist flexor muscle, the palmaris longus, may attach directly to the TCL in many individuals.

The author does not want to lose the casual reader, so let's make this a bit more fun.

Please participate in a gripping scenario with me. Stay focused, as this drill can get tricky if we speed too quickly through it. With your hand, imagine you are holding a small paintbrush (sorry to pick on the artists, but everyone has painted a picture, and painting is a very real challenge to the carpal tunnel structure). Depending on your grip, you are now likely squeezing the 4 small pinky finger and thumb muscles (previously mentioned) that attach to the TCL. The TCL is under stress. Add also that the 8 finger flexor tendons that pass through the tunnel (*under* the TCL) are also contracting to hold the paintbrush. There is pressure on both sides of the TCL. Make sense? Pressure is '*on'* the TCL *AND* pressure is '*under*' the TCL - and the paintbrush has yet to move.

Have a look at the shape of your hand that you have hopefully made while holding your imaginary brush. How much space does there appear to be between thumb fatty pad and the pinky finger fatty pad? Not much, I bet. That's the location of your carpal tunnel. Does it appear to be collapsed? Likely. Does its size seem large or small? Small, no doubt. Can you envision any problems if this daily physical grip demand becomes chronic, and is not addressed?

Now we move the paintbrush while holding it in order to paint our picture, and a few more issues come into question. Painting is a 3-dimensional activity of course, and now the wrist will be flexed, extended, rotated, ulnar-deviated, and radial-deviated in a vast combination of directions while in this static grip condition. The wrist moves a lot, in all directions!

All wrist flexor muscles have an indirect effect on the carpal tunnel. You don't need to get caught up on the anatomy, just know that gripping AND wrist flexing adds stress to the inside of the carpal tunnel. When the wrist is flexed, the finger flexor tendons that hold the brush are brought directly against the inside of the TCL. Is it feasible that the tendons inside the carpal tunnel and the TCL are at greater risk of trauma and inflammation, especially as daily repetition becomes chronic? Tissue inflammation could affect the space and pressure with the carpal tunnel.

The 3 main wrist flexor muscles also *directly* affect the tunnel. As mentioned earlier, the *flexor carpi radialis* (FCR) muscle splits through the TCL and then attaches to the scaphoid bone, which forms part of the thumb-side boundary of the carpal tunnel. The *palmaris longus* muscle attaches directly to the TCL in many cases. The third main wrist flexor muscle, the *flexor carpi ulnaris* (FCU) attaches to the pisiform and hamate bones, which form the pinky-side boundary of the carpal tunnel.

The carpal tunnel is under the constant risk of chronic breakdown, overuse and inflammation during all repetitive gripping activities. If items are being gripped daily, there are stressors being placed on the outside AND the inside of the carpal tunnel structure, and breakdown and imbalance are eminent.

The author is hopeful that you can recognize that even daily repetitive painting IS a physically challenging activity on the carpal tunnel as well as on other parts of the body. I could have a chosen so many other grip-related activities as an example. What does your daily grip activity involve?

Consider also that if the stability of the *kinetic chain of grip* (Chapter 3) of the person who is repetitively gripping (especially small items) is not well established, then the burden of grip is passed onto the small flexor muscles (i.e., because of poor mechanical support) and the cycle of overuse and imbalance may accelerate. In other words, the intrinsic hand closing muscles (that attach directly to the carpal tunnel) are further overworked in cases where finger extensor muscles are weak. The result is further breakdown, swelling and resultant thickening of the borders of the carpal tunnel.

The author's explanation of the possible cause of carpal tunnel syndrome sounds quite dire, but to complete my thought brings not only hope, but also an approach for sensible stability and maintenance of optimum carpal tunnel function. Let's bring some sunshine to the storm.

The author purposely left out 2 intrinsic hand muscles that also attach at the TCL because they are abductor (spreading) muscles.

They are part of what I believe is the solution to maintaining a healthy, stable and functional carpal tunnel. These 2 muscles are the *abductor digiti minimi* and *the abductor pollicus brevis.* Another group of intrinsic hand spreading muscles are the *dorsal interosseous* muscles. These 3 spreading muscles join the hand opening muscles to assist in maintaining the health and stability of the carpal tunnel.

Please take that same paintbrush hand from the previous exercise and simply open it, as wide as possible, please. Your pretend paintbrush will obviously drop from your hand, but let's observe the result carefully. When your hand is opened wide, what does the area over the carpal tunnel look like? Wide? Yes, I assume that to be your answer. Or stable? Or neutral? Yes, all are correct. And that is the goal. Stability, width, function, and neutrality of structure are also the basis of correct training to offset carpal tunnel breakdown.

Feel free to peak ahead to Chapter 9 to view the Handmaster Plus exercise that helps to build a stable carpal tunnel for life, the basic HC/HO exercise. Once again, the training of the 9 muscles that open the hand comes into focus. These 9 muscles are essentially to your hand health and performance..

Handmaster Plus exercises allow any user to easily strengthen all 9 of these muscles that are so vital in the stability of the finger, thumb, hand, wrist, carpal tunnel, forearm and elbow complex. It is a complex that is easily brought into imbalance through repetitive grip, but once understood, become quite easy to correct.

What used to take therapists 4 or 5 complicated exercises to train (with multiple devices that most patients would not follow through with) now takes minutes at most with one device. No more excuses for not training the hands properly, and thus, no excuses for an unhealthy carpal tunnel.

Remember also that poor circulation is regularly associated with carpal tunnel syndrome (i.e., pregnancy, diabetes, obesity, kidney failure, etc.). I believe that this is no coincidence. Where there is a high incidence of poor circulation to the upper extremity, so too is

there likely to be a higher incidence of carpal tunnel syndrome diagnosed.

Like any other area of the body, when the muscles that relate to that structure are exercised regularly through full, natural, balanced ranges of motion, the body innately develops a more efficient circulation to and away from the area (i.e. functional exercise hyperemia). Circulation is essential to keep active areas supplied by oxygen and nutrients, and as well to move toxins and waste products away. Poor fluid flow creates increased pressure within the carpal tunnel.

The body is wise. It reacts to its environment perfectly, whether healthy or not. If not exercised (or if exercised poorly), the carpal tunnel will see breakdown, shortening, repair, thickening and increased pressure.

If exercised properly, the carpal tunnel is apt to maintain its structure, function and internal pressure well. Proper exercise, preparation and training are essential for those at risk for carpal tunnel syndrome.

The author believes strongly in deeply understand and maintaining the strength, stability and integrity of the supportive structures of the carpal tunnel, as well as insuring absolute efficiency of fluid flow to, through and away from the tunnel. In other words, my advice is to focus on *maximum performance* of the carpal tunnel, not just injury prevention. Sound familiar? Keeping your 18 hand muscles strong and balanced can only help to stabilize the carpal tunnel.

Let's look at some examples of the research regarding the carpal tunnel to further understand concerns about this passageway:

Length of Transverse Carpal Ligament (TCL)

The length of the TCL itself is a common focus to researchers indicating that the width of the carpal tunnel is an important characteristic. This makes sense in that the width of the carpal tunnel can narrow, especially chronically, after daily repetitive gripping. It is

a reminder to all to focus on regular training to maintain balanced structure.

One particular study that focuses on the *length* of the carpal tunnel ligament is by Sucher etal[11] created specific static and dynamic loading at locations of the carpal tunnel that increased both the length of the TCL and the width of the transverse carpal arch (the base of the carpal tunnel) thus showing promise for a conservative treatment for carpal tunnel syndrome once diagnosed.

Thickness & Flexibility of the TCL

Another focus of researchers regarding the TCL is in relation to its thickness and flexibility. ZM Li et al discovered 'CTS patients had a 30.9% thicker TCL than control subjects.' As well they conclude that '…the radial TCL region was significantly stiffer than the ulnar region within the CTS group, and such a regional difference was not found for the controls.' The same study concluded that 'The increased thickness and localized stiffness of the TCL for CTS patients may contribute to CTS symptoms due to reduction in carpal tunnel space and compliance.'[12]

Pressure inside the Tunnel

It also makes sense that increased pressure within the carpal tunnel has been linked as a factor in the presentation of carpal tunnel syndrome, and is another focus of carpal tunnel researchers.

Many studies illustrate the correlation between internal carpal tunnel pressure with median nerve dysfunction. My favorite is a New Zealand study [13] of white rabbits. This animal model for CTS demonstrates a direct cause and effect relationship between carpal tunnel pressure and median nerve dysfunction.

Another interesting study was designed to evaluate the diagnostic utility of strain and applied-pressure measurements of the median nerve in carpal tunnel syndrome. The conclusion was: 'Pressure/strain ratio is useful for evaluating the condition of the median nerve with respect to the hardness of the surrounding structures in CTS.'[14]

Increased pressure within the carpal tunnel seems to be a very real concern as a cause of CTS. Proper hand exercise can be sensibly postulated to increase circulation into, through and out of the carpal tunnel to reduce pressure inside. Handmaster Plus has indeed been shown by research to resolve carpal tunnel syndrome (cited study to follow). The author feels that circulation is one of the main mechanisms by which is does so.

Size of the Carpal Tunnel

Does the size of the carpal tunnel seem to be a consideration for whether an individual is more at risk for carpal tunnel syndrome? By comparing the tendencies found between genders, it appears that the size of the tunnel of each individual does play a factor.

A study 2019 compared size and shape differences between sexes and concluded, "This study demonstrates that females have a smaller carpal arch compared to men with a reduced palmar bowing distally and a smaller arch area at both tunnel levels. The findings help explain the higher incidence of carpal tunnel syndrome in women as a smaller carpal arch makes the median nerve more vulnerable to compression neuropathy."[15]

In other words, *size –and shape – matters* when it comes to the health of the carpal tunnel. Our artist paintbrush exercise allowed us to test how physical habits can change the size and shape of the carpal tunnel instantly. Let's make sure we are offsetting any habits that challenge the size and shape of the carpal tunnel using proper hand exercise. Women especially have less room for error.

Repetitive Gripping and Carpal Tunnel Syndrome

For whatever reason, just like tennis elbow, researchers and health leaders seem to shy away from identifying directly that repetitive gripping is associated with high rates of carpal tunnel syndrome. Yet, according to a 2018 California study, "Industries with the highest rates of CTS were textile, fabric finishing, and coating mills (44.9), apparel accessories and other apparel manufacturing

(43.1), and animal slaughtering and processing (39.8)."[16] All are heavy repetitive grip dependent activities.

Any worker or workplace that is dependent on grip must consciously mind the relationship between the 9 muscles that close the hand and the 9 muscles that open the hand. Handmaster Plus is an effective and affordable ergonomic exercise for businesses and easy to use and understand for workers.

Exercise and The Carpal Tunnel

Researchers Unver and Akyolcu carried out a study relating hand exercise to carpal tunnel health using our own product, Handmaster Plus. The study followed the progress of dialysis patients at hospitals in Bursa City Center, Turkey who diagnosed with mild to moderate CTS. The patients performed daily Handmaster Plus exercise.

The study concluded, 'About 21.4% of patients' electrophysiological results were negative at the end of the 1st month and 32.1% of them at the end of the 3rd month. Due to the slowed progress of CTS and detection of slight improvement in evaluation parameters, this self-applicable and practical exercise can be used as an alternative treatment of mild CTS in patients with HD.'[17]

Incidentally, the author is not in favor of using Handmaster Plus exercises as a standard sole treatment for carpal tunnel syndrome as best practise model. The study provides excellent support that Handmaster Plus can sensibly and safely be used to maintain the carpal tunnel and its related structures in dialysis patients. More information is to follow regarding this study in Chapter 10, Great Hands & Circulation.

Once diagnosed with CTS, stabilization, including bracing, followed by treatment from a qualified CTS health care professional is in order. Handmaster Plus is to be used as the primary post-treatment recovery device.

Addendum I - Acute Injury Protocol at the end of the book can provide more a detailed management protocol for CTS sufferers.

Conservative Treatment of Carpal Tunnel Syndrome

Physiotherapy, Chiropractic extremity adjustment and osteopathic manipulation should be central to initial corrective solution efforts for CTS. There is enough evidence that the wrist bone positioning and soft tissue can directly affect the tunnel and its contents.

According to Kai-Nan An et al., '…the transverse intercarpal ligaments connecting the bones of the distal carpal row were shown to have an essential role in providing stability to the carpal tunnel.'[18]

Researchers in Spain and the U.S studied the cases of 100 women with carpal tunnel syndrome. By random allocation, 50 women were treated with physical therapy and 50 with surgery.

The researchers concluded: 'Based on the results of the current study and a previously published study in 2015 we would suggest that patients with carpal tunnel syndrome should first undergo a conservative approach to treatment including a multi-modal manual physical therapy program prior to surgical intervention in most cases.'[19]

Ultimately, there is agreement that conservative treatment of CTS should first be pursued, with surgery being a final option in reversing CTS.

Ultimately the best treatment is prevention. Understanding the structure of your carpal tunnel and minding your Great Hands is your best path to avoiding CTS altogether.

Ok, that's it for a BRIEF look at the research available regarding the carpal tunnel.

Proper exercise is essential for maintaining the integrity of the carpal tunnel especially in repetitive grip dependent individuals, and more so in individuals who grip small items in palm down positions, and items that vibrate. Dental hygienists, assembly line workers are front and center, but all grip athletes, musicians, workers, gamers and

hobbyists must have a routine to care for the carpal tunnel and the rest of the mechanical factors of gripping.

Pregnant women must take care to maintain hand wrist, carpal tunnel and elbow health due to the possible pressure effects of poor circulation through the carpal tunnel.

My initial interest in CTS stemmed from the story of Golf Hall of Fame member and famous golf broadcaster, Ken Venturi, having to quit golf because of CTS in both hands.

The message of this chapter: If you grip regularly, you must become knowledgeable and aware of your carpal tunnel health, stability and function.

Go to Chapter 9 anytime to learn the easy and complete hand muscle training routine that anyone can do in minutes per day that help to manage your carpal tunnel fitness and stability.

That wraps up the issue of grip challenges to the elbow, wrist, forearm and carpal tunnel. Maybe it is that time we spoke about how repetitive gripping and poor hand exercise habits actually affects the hands themselves, including the fingers and thumbs.

Chapter 8
Great Hands, Fingers, and Thumbs

Isn't it interesting that in a book about Great Hands we are on Chapter 8 before we even mention the effect that training the hand muscles properly has on the hands, fingers and thumbs themselves? That's how far reaching the hand muscles are in their contribution to the stability of so many other structures.

It is also reflective of how we commonly forget about their health and fitness. Until they hurt, that is. It's time to have a closer look at the hands, fingers and thumbs, maybe for the first time.

If you have made it this far in the book, you will know how important it is to pay attention to the hands and all of their associated muscles. The hands, fingers, and thumbs are our direct connection to most of our life demands, interests, and dreams. Let's get them right! Let's ensure they are in peak condition so that we can reach well for our goals.

Because we have covered the health, stability and fitness of so many related structures, the strength and balance of the hands, fingers and thumbs will seem much easier, as they are followers of the same natural laws, the same *house rules*, as Dan Millman would say. The hands, fingers and thumbs will, in essence, will allow us to pull this whole area together, most nearly as a review.

Some basic anatomy.

Within what we normally consider to be our hand (i.e., we'll include the hand, fingers, and thumb) are 19 bones (5 metacarpal (hand) bones, 12 finger bones (3 per finger x 4 fingers = 12), and 2 thumb bones) and 19 joints attached together by ligaments, and made moveable by 18 hand muscles

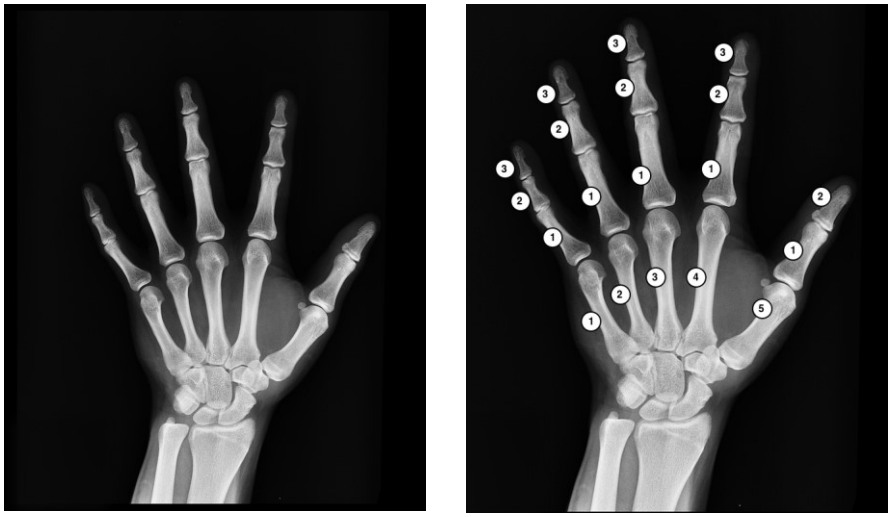


Fig. 30 Bones & Joints of the hand, fingers, and thumb

From Chapter 1 we know:

9 muscles close the hand.

9 muscles open the hand.

The joints of the hand, fingers, and thumb are all capable of the movements of flexion and extension (i.e., closing *forward* and opening *backward*), as well as abduction and adduction (i.e., spreading *outward* and spreading *inward*).

The thumb and pinky share the special motion of *opposition*, which allows for motions of pinch. From Chapter 7 we know that the action of daily *opposition* motion can be a challenge on the space and shape of the carpal tunnel (remember the imaginary paint brush?). Thus, the abductor (i.e., spreading outward) muscles of the hand become integral and must be trained to oppose *opposition*. Whoa, '*oppose opposition*?' Sounds strange, but the author feels this is *vital* to understand, especially if you use small items daily (i.e. pen, computer mouse, guitar pick, paintbrush, dental tools, soldering iron, gamer console, scalpel, aesthetician tools, etc.).

The thumb is a saddle joint and thus allows for circumduction, a wide circular movement combining extension, flexion, abduction, and adduction. The thumb is commonly exposed to arthritis, tendonitis and dislocation because of its wide range of motion design.

The thumbs and fingers give us a wonderful opportunity to review the *kinetic chain of grip* from Chapter 3.

Remember that whenever we grip an item with our thumb and/or fingers, the supportive extensor muscles contract in cooperation with the flexor muscles to get the job done properly. If they didn't, the flexor muscles would be trying to grip the item without any support. It just wouldn't work. Review the sEMG patterns in Chapter 3 that show both the extensor muscles AND the flexor muscles working together cooperatively in hand and grip activities.

Yes, the *kinetic chain of grip* is alive and well in the functioning of the thumb and each finger as well. The finger extensor muscles contract to support the finger flexor muscles and the thumb extensor muscles contract to support the thumb flexor muscles. Thus, athletes, musicians, workers, gamers and hobbyists alike that use their fingers and thumbs to grip must train the *front and back* of the fingers and thumbs if they expect maximum health, balance, performance and stability.

The baseball pitcher example was used in Chapter 3 but endless examples exist of extremes of finger and thumb grip. Climbers who do not train with consideration to these mechanics can feel perfectly strong one day and then suddenly develop instability problems. The longer the *kinetic chain of grip* is ignored, the greater is the chance of experiencing weakness and injury.

We asked the question, 'Why have we historically only trained our hands in a 'squeeze-only' motion when the extensor muscles are just as important to gripping, grasping and finger motions? Change is happening. And more change is on the horizon.

Every time we learn something new about hand and grip related exercise, we discover more secrets that the body is trying to teach us.

As the author started to understand the importance of exercising the hand, fingers, and thumb through full ranges of motion, an amazing change was noted that was not originally anticipated when developing these exercises – *circulation.*

Now the author feels that proper hand exercise should be a must for everyone, not just those who are grip-dependent. The exercises in this book may serve so much larger of a population to assist in improving general health. Why? Because improving the complete function of the muscles of the hand improves upper extremity blood flow, which also improves venous blood flow and lymphatic drainage. Better lymph drainage from the upper extremity is very likely to influence the function of the ***lymphatic ducts,*** which are located just proximal to the upper arm. The lymphatic ducts are essential in removing wastes and toxins from the entire body, including the brain.

Could complete hand exercise and resultant improved circulation improve mental health, general health and life longevity?

More to come on circulation in Chapters 10 and 12, but it is well worth a mention here to recognize the important relationship between the health of the hands, fingers and thumbs and the complete health of the body.

Lymph duct stimulation via hand exercise is largely theoretical and feedback is anecdotal at the time of this printing, but proper hand exercise may be placed on a much larger stage as more attention is focused on related research. Chapter 12 will expand, but health and longevity hints are everywhere in published literature.

So let's talk about what exercise considerations are to be considered when creating Great Hands? In other words, how do we develop the most stable, functional and healthy hands, fingers, and thumbs?

From the author's experience in developing Handmaster Plus and subsequently working with professional and amateur grip-related athletes, musicians, workers, gamers, and hobbyists, the health

histories and stories of nearly all of these folks has been the same when it comes to training their hands for grip:

1. They do nothing
2. They perform 'squeeze-only' hand exercise

Let's cover the second category first. The '*squeeze-only'* approach. I get it. When the author was originally a young athlete, I was a *squeeze-only-er* also. But you know the story. I was eventually coerced into exploring the elbow, and then (eventually) the whole process of hand exercise.

Very simply, as the author has discussed *ad naseum* throughout the book, when we design any exercise approach, we must respect the natural design of the body's structure. When I started to focus on repetitive grip related issues in practise, I soon realized that what I had being using for hand exercise all of my athletic life was not complete at all, and was likely creating imbalance. My *squeeze-only* approach to preparing for hockey, golf and basketball reflected almost no understanding to the design of the hands.

3 Key factors are ignored when *squeeze-only* training is the approach of choice to exercise the hands, fingers, and thumbs:

1. Balance
2. Full Range of Motion in 3-Dimensions
3. Maximum Blood flow

1. Balance

It is likely now that all readers are now aware that 9 muscles close the hand and 9 muscles open the hand. Thus, our hand exercise strategy must reflect the understanding of this design. *Squeeze-only* approaches to hand exercise can lead towards an imbalance between the muscles that close the hand and the muscles that open and spread the hand.

As we know, hand muscle imbalance leads to instability of many structures other the than the hand. Poor hand muscle posture can adversely affect the wrist, carpal tunnel, forearm, and elbow. That means not only health and stability concerns, but also performance challenges.

For example, in basketball, an important part of the basketball shot involves setting the wrist *back* in preparation for shooting the basketball towards the target (the basketball hoop). The greater and more natural the set angle, the more range (distance and height) and spin the player can create effortlessly by deault. When finger flexor muscles are shortened versus the finger extensor muscles, the basketball player cannot create an optimum natural set angle.

Which leads to our second, and related consideration for proper training of the hands, fingers and thumbs…

2. Full Range of Motion (ROM) in 3-Dimensions

In practise, even when the author finally realized the need to train all 18 muscles of the hand, as well as the support muscles of grip in the forearm, it still required multiple devices and multiple exercises to accomplish this, to the dismay of most athletes, patients and myself. Spring loaded items, webs, elastic bands, rings, etc., all laid around the treatment room. It was awkward.

The author especially remembers the frustration of trying to exercise the finger opening and spreading muscles (i.e., the 9 muscles that open the hand), vital muscles related to the successful outcome of each patient. Elastic bands were used to try to accomplish finger and thumb extension. Each time the patient would attempt to open their hand wide fully, the elastic band would slip off. When elastic bands were required to be wrapped the around individual fingers and thumb to resist specific abduction (i.e., spreading) of the fingers and thumb, the patient would forget the process. The exercise would then require re-loading and re-explaining.

It frustrated the author to no end that full ROM exercises could not be achieved; only partial ROM. Nothing was easy. There was

time-consuming confusion in treatment rooms and, consequently, only a small percentage of patients would comply and actually do the exercises. Especially once they felt healthy. Continuity was difficult.

The author also remembers being concerned that some exercises made the hand move in 2-dimensions only (i.e., in one plane). When patients used coiled or spring-loaded grippers or grip rings, the design of the product determined the hand exercise. These devices move the hand in one plane only, whereas the hand moves naturally in 3-dimensions. I began using racquetballs instead for this reason.

It wasn't until I initiated the rough design of the first prototype of Handmaster Plus that the author felt truly competent to train hand and grip muscles. The hand itself now determined the ROM of the exercise, not the exercise item or the memory of the patient. They would simply open their hand for one second and then close their hand for one second and repeat. Full natural range of motion for all 18 hand muscles in 3-dimesions.

It was awesome.

The most thrilling part of initially developing Handmaster Plus was that the patient gained: 1) resistance to their natural hand motion, 2) convenience to completing their exercise, and 3) ease of understanding the exercise and the muscles involved. I could finally give instructions and know that my athletes, musicians and other patients were on the road to proper balance, stability and performance.

What the author soon began to realize is that full ROM hand training seem to lead to healthy hand structures due to a third vital exercise factor that opened up many new application possibilities:

3. Maximum Blood Flow

When the hand is moved through only small ranges of motion, the innate reaction by the body is to stimulate less blood flow to the area because, in essence, the structure is being perceived as not being fully used. The body has need for blood flow to structures elsewhere in the body that *are* being used. This is why it is essential to move the

hand through its full natural 3-dimensional range of motion to create health and function.

It is a reminder of the concept of *functional exercise hyperemia* from Chapter 5a.

When the hands are moved through full, natural, 3-dimensional ranges of motion, blood and fluid flow is maximized to all tissues, including joint cartilage, ligament, muscles, tendons and fascia. Better circulation means that the tissues receive the oxygen and nutrients needed to maintain health, stability and daily repair, as well as better removal of waste and toxins away.

And what of the folks that are repetitive gripping regularly, but '*do nothing'* in regards to healthy hand exercise? Earlier in this chapter, we reviewed the many joints within the hand, fingers and thumb (19!). When we repetitively grip, we are bearing stress on a small area of all of these joint surfaces. Can it be surprising to anyone that these joint areas break down over time? Wear and tear osteoarthritis is fundamentally predictable in many grip activities.

To hobbyists that sew, knit, or stitch regularly, small ranges of joint surface on all hand, finger, and thumb joints are under a constant physical stress barrage. Artists that paint using a small paintbrush are at the same high risk. Assembly line workers who work with small tools… guitarists who grip picks… the list goes on and on…

Wear and tear arthritis and soft tissue injury conditions are predictable outcomes for repetitive grippers who do not understand joint health and do not make an effort to provide a proper regular hand exercise environment that stimulates the body's natural circulation, waste removal and repair.

Let's vote to change the saying, 'Move it or lose it,' to be more accurately, 'Move it *in balance* or lose it.' The body knows how to repair. We have to learn how to provide our body with the healthy daily environment necessary to do so.

As Baby Boomers age and the digital age becomes more and more engrained in our world, proper hand exercise can no longer go

ignored. We will start to see more and more fingers, thumb, hand, wrist, carpal tunnel, and elbow instability, and there will be a louder cry for help. Let's not wait until then. Instead, let's be at our best.

There is no longer any excuse for ignoring proper hand exercise once you understand the hands and the concept of the kinetic chain of grip. Handmaster Plus makes hand exercise simple, convenient and complete. Everyone can have Great Hands, if they want to.

We've sure spoken a lot about the Handmaster Plus exercises. Now let's see them.

CHAPTER 9
HANDMASTER PLUS EXERCISES

A QUICK REMINDER ABOUT EXERCISE: As with any exercise program, consult your health care professional before beginning Handmaster Plus exercises. If pain is experienced, discontinue use immediately and consult a health care professional.

A complete list of Handmaster Plus exercises can be viewed on video at Handmasterplus.com/exercises

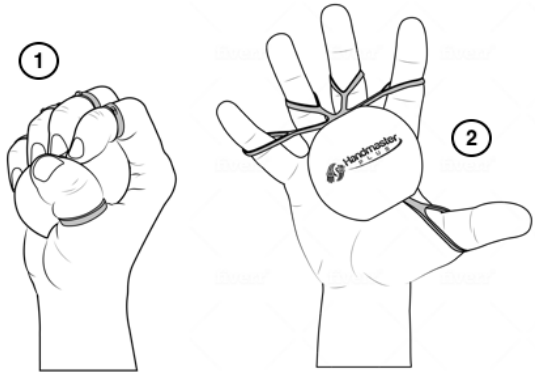
Handmaster Plus consists of a simple customized ball and cord combination that allows users to move their fingers, thumbs, hands, wrists, and forearms naturally against resistance. The motion of the hand determines the exercise, not the design of the product. The user places the thumb loop on the base of their thumb (first) and the finger loops mid-knuckle on each finger (second). Each specific exercise has been designed based on over 20+ years of research focusing on hand muscle function, isolation and balance strategies.

There are 4 main Handmaster Plus exercises that are recommended to most users based on their specific daily grip and hand health related activities. Each will be described below including examples of activity-specific application.

1. Hand Close / Hand Open ('HC/HO') Exercise

Applications: For everyone.

Prerequisite: Must be able to close and open hand discomfort free without resistance (i.e., without Handmaster Plus). Start with the soft strength Handmaster Plus and progress as required.



Step 1: Close the hand for 1 second against the resistance of the ball.

Step 2: Open and spread the hand for 1 second against the resistance of the finger cord.

Step 3: Repeat until comfortable fatigue.

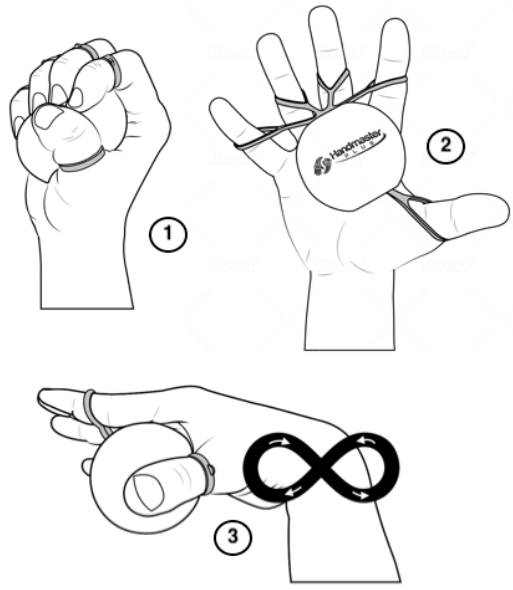
HC/HO was the first Handmaster Plus exercise developed. It has changed the landscape of fundamental hand exercise offering one easy-to-do and easy-to-understand exercise that strengthens and balances the 9 muscles that close the hand AND the 9 muscles that open the hand, all through full, natural, 3-dimensional ranges of motion. The result is strong, balanced, and stable hand muscles, as well as maximum blood flow to and from all tissues of the hand. HC/HO has stood the test of time for over 15 years as a go-to exercise for all.

Perfect for use as a complete post-treatment recovery exercise or as for comprehensive hand muscle training.

2. The Figure 8 Exercise

Applications: For individuals requiring a strong, healthy, stable grip performance.

Prerequisite: Must be proficient at Handmaster Plus HC/HO exercise. Start with the soft strength Handmaster Plus and progress as required.



Step 1: Close the hand for 1 second against the resistance of the ball.

Step 2: Open and spread the hand for 1 second against the resistance of the finger cord.

Step 3: Make a full, wide figure 8 motion using your wrist while keeping the hand open.

Step 4: Repeat until comfortable fatigue.

The Figure 8 Exercise is used by grip-related athletes, musicians, workers, esport athletes and hobbyists to properly train the entire *kinetic chain of grip*. One continuous exercise stimulates all 18 hand muscles (i.e., 9 hand closing, 9 hand opening muscles), as well as the 9 forearm muscles that support all wrist positions - all through full, natural, 3-dimensional ranges of motion. The result is maximum

balance and circulation and strong, stable grip and grip support muscles that perform well and resist fatigue.

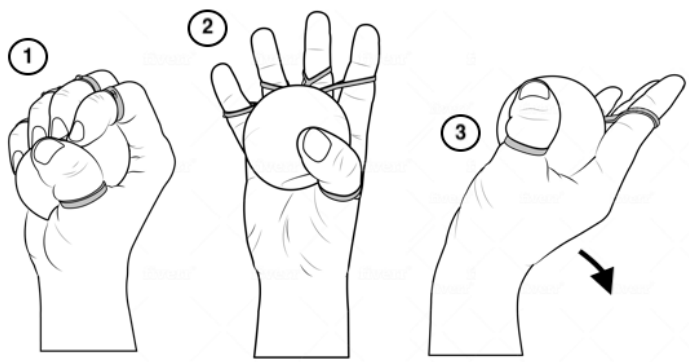
The Figure 8 Exercise allows users to train all grip related muscles without creating grip dilemmas at the elbow and wrist. It is a complete grip training exercise that saves users time without sacrificing proper grip mechanics or results.

The Figure 8 Exercise is changing the landscape grip training and can be used as advised by a healthcare professional for late stage recovery from wrist, forearm and elbow injuries.

3. The Lateral Forearm Exercise

Applications: For effortless natural wrist extension (i.e., basketball, volleyball, tennis, darts, etc.) and post-treatment recovery from tennis elbow, lateral forearm or wrist extension injuries.

Prerequisite: Must be proficient at Handmaster Plus HC/HO exercise. Start with the soft strength Handmaster Plus and progress as required.



Step 1: Close the hand for 1 second against the resistance of the ball.

Step 2: Keeping the thumb on the ball, extend only the fingers for 1 second.

Step 3: Extend the wrist back for 1 second.

Step 4: Repeat until comfortable fatigue.

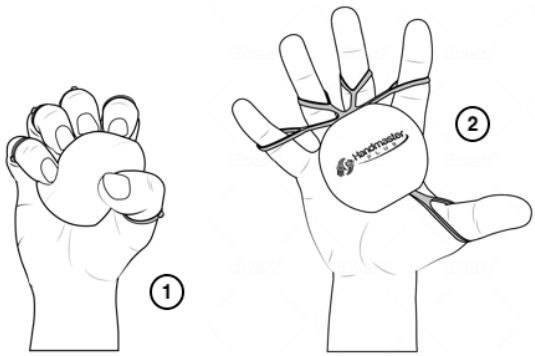
For grip-dependent individuals who are looking to establish concurrent natural wrist extension, this is a simple and effective approach.

The Lateral Forearm Exercise can also be used in post-treatment recovery (as advised by a health care professional) from tennis elbow, lateral forearm or wrist extension injuries. In late stage post-treatment recovery, patients may progress to the Figure 8 Exercise. Consult with your health care professional if you have questions.

4. The Finger Tip Grip Exercise

Applications: For finger and thumb tip grip strength (i.e., climbers, guitarists/musicians, baseball pitchers, football QB/catch/tackle, cricket bowlers, MMA, crafts/sewing, etc.)

Prerequisite: Must be proficient at Handmaster Plus HC/HO exercise. Start with the soft strength Handmaster Plus and progress as required.



Step 1: Squeeze the ball for 1 second using the **finger and thumb tips** only.

Step 2: Open and spread the hand for 1 second against the resistance of the finger cord.

Step 3: Repeat until comfortable fatigue.

For individuals that demand strong grip from their finger and thumb tips, you'll not find a more complete, challenging, effective specific finger tip grip exercise. The Finger Tip Grip Exercise strengthens the action (flexors) muscles of distal finger grip as well as the grip stabilizer (extensors) muscles, resulting in strength, competence and complete balance of tip grip musculature. Combine the Finger Tip Grip Exercise with the Figure 8 Exercise for complete grip mastery.

There are nearly endless benefits of developing Great Hands. Now that the reader has a strong base of awareness of the hand muscles, the challenges of repetitive gripping and proper grip training exercise solutions, let's open up the curtain and explore in detail why hand and grip muscle health is more important than you have likely ever imagined…

CHAPTER 10
GREAT HANDS & CIRCULATION

(POST-TREATMENT RECOVERY,

ARTHRITIS, DIALYSIS AND MORE)

There is no need to go into great detail again about the role of full range of motion exercise in relation to stimulating healthy blood flow and circulation, including lymphatic drainage. These topics have been referred to throughout the book.

The concept of lymphatic drainage will be expanded upon more in Chapter 12, Great Hands & Longevity.

Refer if necessary to Chapter 5A, Grip Dilemmas at the Elbow (Core). There you will be reminded of thermography study of 2017, which showed the differing results in circulation one minute after full range of motion Handmaster Plus exercise and after 'squeeze-only' grip exercise. The results are strikingly different because the body responds to full range of motion exercise by increasing the efficiency of circulation to and from those tissues.

Please also review the concept of *'functional exercise hyperemia,'* which was also addressed in Chapter 5A. The body is wise and adaptive increasing circulation when, where and to what extent an area is utilized by an individual.

Circulation is a big deal. The circulatory system in the body is responsible for the transport of oxygen, nutrients, and metabolic wastes, as well as the life-dependent exchange of oxygen and carbon dioxide, PH balance, fluid volume, fluid pressure and protection from infection. Blood and lymph fluid are the transport mechanisms that serve this cycle of health throughout the body.

We would all be wise to mind the status of circulation within our bodies. Exercise is one of the main factors to will ensure that our

circulation is efficient. Plus, exercise makes us feel great. Win–win, correct?

Imagine the traffic system of a large city. We are attempting to bring time-dependent packaged supplies into the city, remove the packaging, use the supplies, and then take the packaging back out of the city for recycling. Pretty simple process, right?

But what happens in a traffic jam? Or if we run into road construction? Or a traffic accident has occurred? Most of us know these scenarios. The goods do not arrive on time, if at all. Strict supply needs go unmet. Jobs, processes and projects suddenly have shortfalls. Desired outcomes are weakened. The intended job, process or project is not wholly healthy.

What happens if the recycling process is ignored? Or if a traffic jam/construction/accident does not permit the recycling vehicle to complete the recycling trip ably *back out of the city*. Waste accumulates. The job, process or project would produce a toxic environment.

This metaphor is happening all throughout your body every day. When we realize the importance of complete circulation in our body, we can apprize ourselves regularly the need for exercise.

Great Hands ensures that the traffic flow into the city (blood supply to the grip related structures) is maximized to all *kinetic chain of grip* tissues (muscles, tendons, ligaments, fascia, joint surfaces), and that the recycling process (venous and lymphatic drainage away) is efficient.

This traffic flow example may also serve as a friendly reminder to always mind the supplies (your diet) brought into your city…

The author loves the word *circulation*, originating from Latin word *circulation,* 'to form a circle.' How much would our health and fitness benefit if we are conscious to bring good supplies into our body, and to support healthy transport of nutrients in and digestion of waste out in an every continuous circle.

Diet, rest, exercise, balance, water, and a healthy mental attitude are but a few key health habits that support each of our ion-going circles of health.

Circulation & Post-Treatment Recovery

If you or a loved one has experienced a thumb, hand, wrist, carpal tunnel, forearm or elbow injury or overuse condition, reducing symptoms should not be your focus. Re-establishing Great Hands should be your goal.

Three steps re-establish Great Hands after an injury:

1. Stabilization – 2. Treatment – 3. Recovery

This Acute Injury Protocol has been added as **Addendum I** at the end of the book (please reference, if desired). If an injury creates an emergency, act accordingly. Call an ambulance or travel safely to a hospital.

If the injury is not an emergency, follow ***Stabilization*** instructions listed in **Addendum I** as represented by the acronym PRICE. Consult a health care professional as soon as possible for consultation.

Next, get ***Treatment*** from a health care practitioner that is skilled in the treatment of upper extremity injuries, overuse and imbalance conditions.

After treatment, ensure *Recovery*.

Post-treatment Recovery is often overlooked after treatment, but is a vital final step in 1) returning to maximal function, 2) preventing chronic limitation or instability, and 3) preventing re-injury.

Use the exercises in this book as instructed by your health care professional to re-establish efficient circulation, muscle balance and joint function.

You may be surprised how well this simple formula works and how well your body can heal when it is understood. The author has

been surprised many times over the years, thanks to the feedback of many.

The exercises within this book were originally scrutinized and popularized as a consequence of the work of individuals within many health care professions (OTs, PT's, athletic trainers, chiropractors, hand therapists, ergonomists, strength & conditioning coaches, massage therapists, osteopaths, rehabilitative therapists and more), fitness trainers, and therapy distributors around the world. Their feedback over the past 20 years has been invaluable. Anyone who benefits from Handmaster Plus exercises owes a debt of gratitude to these early first-adopter professionals.

The author has gained profound insights and breakthroughs that could only be possible as a result of working with individuals who have viewed grip and recovery concepts while perched at the top of their craft.

On a personal note, the author has enjoyed working with, assisting and gaining feedback from all private patients. These experiences shaped my understanding of the hands and in many cases, woke me up to the vast responsibilities and challenges involved in questioning standard exercise beliefs on their behalf. What occasionally seemed a curse has proven only to be a blessing and an awakening to action.

As the exercises became better known and understood, an added bonus has been the experience of working with many elite athletes (and teams) and musicians. The author is not at liberty to mention names, but these are some of the elite performers within my fields of passion, as well as in grip activities I knew little or nothing about.

In sports, the author has had the privilege of working with elite professional and amateur athletes, coaches and trainers in all major team sports (football, basketball, baseball, hockey), major individual sports (golf, tennis, MMA, boxing, gymnastics) and most *lesser-known* grip sports.

In music, working with numerous bands and musicians including Hall of Famer band members, Grand Ole Opry members, and relative no-namers alike has been a thrill. I've met and assisted life long favourite musicians only to find them be gracious, fun, marvellously talented and open to discussion about grip related problems.

The learning opportunities and experiences have been enjoyable and have pushed the evolution of the Handmaster Plus exercises for all. These experiences have also pushed the author through the many varied challenges and growing pains to bring hand muscle and grip information responsibly to the public at large.

Three main factors affect the success of an individual's post-injury recovery. These 3 factors come up over and over regardless of the grip endeavour, injury or skill level. Handmaster Plus exercises are designed specifically to ensure the user attains all 3. They are: 1) rebuild muscle balance, 2) stimulate neuromuscular pathways, and likely most importantly… ***3) maximize circulation.***

As mentioned early in the chapter, circulation permits healing and prevents toxicity. The body cannot heal, rebuild or recover from any condition without reparative nutrients and waste removal. Handmaster Plus can be used non-invasively to ensure that the post-treatment recovery and rebuilding process is complete and efficient.

It is not necessary for health care professionals or fitness trainers to change any part of their standard finger, thumb, hand, wrist, carpal tunnel, forearm or elbow treatment protocols. Handmaster Plus is designed to provide health care professionals with a simple and complete post-treatment recovery exercise to maximize circulation (i.e., speed recovery) and to regain and maintain structural stability efficiently after treatment is complete.

Circulation is vital within the process of any complete post-injury or old injury recovery. The body heals well, but requires a reason to do so. When we leave it alone, without stimulation, *It* has other chores with which to attend. 'Use it *in balance* or lose it.' When it comes to grip related post-injury recovery, use the hand and grip muscles

sensibly (through full natural ranges of motion with sensible resistance), recover quickly, and recover well.

Circulation & Arthritis

An all too common condition that is aided greatly by a strategy of sensible exercise to improve circulation is arthritis.

Arthritis sufferers have used the Handmaster Plus soft strength product successfully for many years to reduce discomfort and improve function. Full range of motion exercise means better circulation and better healing and repair of the joint surface of the fingers, thumbs, hands, and wrists.

Studies have been published for many years supporting the benefits of exercise for arthritis. That said, the author has always stressed the word 'sensible' as arthritis is a wide reaching catchall term that may not consider the specific condition of each individual.

Always consult a health care professional before commencing Handmaster Plus exercises if you feel you may have an arthritic condition. Next, ensure that you can open and close your hand fully without resistance and without pain. If so, start with Handmaster Plus soft strength product and perform the basic HC/HO Exercise from Chapter 9 based on the advice of your health care professional.

Let's look at some recent studies regarding exercise and arthritis.

A 2009 study evaluated forty women (20 patients with rheumatoid arthritis and 20 healthy controls) who performed a hand exercise program. The results of the program were evaluated after 6 and 12 weeks with hand force measurements.

Their findings: 'A significant improvement in hand force and hand function in patients with rheumatoid arthritis was seen after 6 weeks of hand training; the improvement was even more pronounced after 12 weeks. Hand exercise is thus an effective intervention for rheumatoid arthritis patients, leading to better strength and function.'[20]

The aim of the 2015 SARAH study was to estimate the clinical effectiveness and cost-effectiveness of adding an optimised exercise program for hands and upper limbs to standard care for patients with rheumatoid arthritis (RA).

Their findings: 'The results of the strengthening and stretching for Rheumatoid Arthritis of the hand trial suggest that the addition of an exercise programme for RA hands/wrists to usual care is clinically effective and cost-effective when compared with usual care alone. No adverse effects were associated with the exercise programme. The economic analysis suggests that the intervention is likely to be cost-effective.'[21]

A 2016 study by Hammond and Prior evaluated 19 previous trials to investigate the effects of home hand exercise programs on hand symptoms and function, again in RA patients.

Their findings: 'Significant short-term improvements occurred in hand function, pain and grip strength, with long-term improvements in hand and upper limb function and pinch strength. Home hand exercise programmes are effective at improving hand function, grip strength and pain in RA. High-intensity resistance exercise programmes seem to be most effective and are cost-effective. Further research is required to evaluate methods of helping people with RA maintain long-term home hand exercise.'[22]

The 2018 Ottawa Panel study performed a systematic search and adapted selection criteria included comparable trials with exercise programmes for managing hand osteoarthritis.

Their findings: 'Despite that many programmes involving exercise with positive recommendations for clinical outcomes are available to healthcare professionals and hand osteoarthritis patients that aid in the management of hand osteoarthritis, there is a need for further research to isolate the specific effect of exercise components.'[23]

In a 2019 study, researchers conducted in-depth interviews with 16 adults with RA patients aged between 68 and 75 years, who had

taken part in randomized controlled trials performing moderate- to-high-intensity exercise with individual guidance. The analysis resulted in six categories relating to effectiveness and transition to exercise independence.

Their results: 'The exercise was experienced as manageable and positive, by a careful introduction and development of an individual exercise routine in partnership with a physiotherapist. This seems to have favored the development of self-efficacy, with importance for future independent exercise. Reduced physical health, both temporary and permanent, was described as a considerable barrier for exercise. The personal process of trying to make the exercise one's own, and developing knowledge about exercise and new thoughts about oneself, seemed to prepare the participants for managing independent exercise and overcoming barriers. Exercise routines need to be flexible enough to fit in with life.'[24]

In summary, hand exercise is shown to be of benefit to arthritis sufferers, but we are just at the beginning stages of knowing why (through research) and developing best-practise independent exercises that are maximally functional and convenient such that users will comply in stimulating healing and repair.

Handmaster Plus exercises provide arthritic users complete range of motion exercise with sensible resistance. The result is an advanced stimulation of natural circulation. As suggested by the studies, any exercise program should be explained, introduced and under the consultation of a health care professional.

As always, Handmaster Plus will be donated to any approved study that wishes to explore the relationship between full ROM hand exercise and arthritis. The author is confident that the result will be positive and many more people may be helped to be and feel healthier and to function better.

The study to follow did use Handmaster Plus in a fascinating study that has diverse implications.

Circulation & Dialysis

A study published in 2018 by researcher Unver and Akyolcu was conducted in patients with hemodialysis (HD) who were treated in dialysis centers and state hospitals in Turkey between 2011 and 2012. The aim of this study is to determine the effects of hand exercise (using Handmaster Plus) on symptoms and to evaluate the results in HD patients with CTS. The study included 19 patients (28 hands) that were diagnosed as CTS.

The same study was mentioned previously in Chapter 7, The Carpal Tunnel.

Their findings: 'Due to the slowed progress of CTS and detection of slight improvement in evaluation parameters, this self-applicable and practical exercise can be used as an alternative treatment of mild CTS in patients with HD.'[25]

This is exciting result for carpal tunnel syndrome sufferers because about 1/3 of the participants had no electrophysiological sign of carpal tunnel syndrome by the end of the third month.

But the story does not stop there. The author had come into contact with the talented and much published researcher, Dr. Seher Unver, in 2019 during the process of compiling information for this book. She is one of the researchers involved in the study. I wanted to learn anything I could from her experience. Dr. Unver was eager to inform me of additional feedback and observation from the study.

The first feedback upon our initial contact was that the hemodialysis patients really liked the Handmaster Plus device and that it made their fistulas better. The type of fistula that Dr. Unver was referring to is an artificial fistula inserted between an artery and vein of an individual receiving hemodialysis treatments.

Upon our next communication Dr. Unver informed me that she had kept a journal of notes during the study and shared a few additional insights with me:

'During my working life and also this study, I was focused on fistula health. There are different types of fistulas. It depends on their places on the arm and their arterio-venous connections. Patients with

CTS who had especially snuffbox and brescia-simino fistulas were affected the best after HMP (Handmaster Plus) exercises.

…one of our patients was at risk of fistula stopping. The pump rate was really low and had pain on hand. He was also not diagnosed with CTS after EMG but I gave HMP to him and followed the fistula. The pump of the HD machine was improved from nearly 200ml/min to over 300ml/min among one week.

…many patients with mild CTS expressed that their sleep were better at night.''[26]

(More to come in Chapter 12 regarding the author's opinion of this type of comment which has been heard often).

Dr. Unver agrees that studies must be designed that can document fistula function during HMP use under controlled conditions. She also suggested a plan for such a study!

Dr. Unver also suggests that she, as I, believes that HMP can have a positive affect on lymphadenopathy cases, but again stresses that further study is necessary. Dr. Unver also suggested a second study plan for lymphadenopathy!

Are there any readers out there that are researchers? So much is to be learned about the possible benefits of full ROM hand exercise and healthy resultant circulation.

Dr. Unver also reported in her diary notes that she was using HMP Medium strength product during the entire study, commenting that the weaker patients in the trial struggled with the resistance. No side affects were reported, but we both feel that the soft Handmaster Plus should be available to all. In future trials, or if dialysis nurses wish to test Handmaster Plus with their patients (and fistulas), the Soft strength should be used to start and Medium strength only issued if progression of an individual patient is need.

When full range of motion hand exercises becomes a habit and improved circulation is the result, the mind of the health care professional and researcher alike can and should wander. Full range

of motion hand exercise is noninvasive, without side affects in nearly every single user. Even studies on more at-risk arthritis, dialysis and carpal tunnel syndrome sufferers seem to report no adverse reactions to hand exercise.

Could Handmaster Plus exercises be used as a daily fitness tool for individuals diagnosed with all kinds of circulation conditions like diabetes, lymphadenopathy, or Raynaud's disease?

Therapeutic trials of any size or formality should always be monitored professionally, but should be humanely considered for all, because circulation is one of the body's main natural healers.

Exercise and circulation is that important.

CHAPTER 11
GREAT HANDS & STROKE RECOVERY

The information collected and assembled in the process of understanding the kinetic chain of grip originally for athletes has been of great use for those individuals who've had, or are at risk of having, a stroke. Indeed, the concept of working towards the attainment of Great Hands can aid and inspire the stroke sufferer and caregiver alike.

The topic of stroke and stroke recovery is a health care concern that stresses entire health care systems. It is a multi-billion dollar issue.

At the same time that we discuss costs of care, we must always keep in mind that these are real and individual humans involved. A stroke event completely alters lives of individuals and their family members.

No one wins when someone has a stroke. We must consider convenience, efficiency and cost-effectiveness when finding solutions to assist our stroke sufferers as we aid them back towards health, confidence and independence.

First, some statistics for perspective:

According to The American Heart Association Statistics Committee and Stroke Statistics Subcommittee:

'Every year, more than 795,000 people in the United States have a stroke.

About 610,000 of these are first or new strokes.

About 185,000 strokes—nearly 1 of 4—are in people who have had a previous stroke.

Stroke is a leading cause of serious long-term disability.

Stroke reduces mobility in more than half of stroke survivors age 65 and over[27].'

According to stroke.org.uk:

'Every two seconds, someone in the world will have a stroke.

Almost two thirds of stroke survivors leave hospital with a disability.

There are more than 100,000 strokes in the UK each year; that is around one stroke every five minutes.

Stroke is the fourth single leading cause of death in the UK.

There are over 1.2 million stroke survivors in the UK.

The NHS and social care costs of stroke are around £1.7 billion a year in England.'[28]

According to the CDC, stroke was the 5th leading cause of death in the USA in 2017.

According to Saebo.com: 'In 2010, strokes cost the U.S. $71.55 billion to treat. By 2030, the costs of stroke are expected to double to $183.13 billion.'

According to ninds.nih.com, 'For some stroke survivors, rehabilitation will be an ongoing process to maintain and refine skills and could involve working with specialists for months or years after the stroke.'[29]

It is true that stroke is a concern to millions of individuals and family members and to health care systems as a whole.

The concept of Great Hands can be a guiding light to those affected by stroke, creating not only hope, but a sensible, simple and

efficient baseline recovery exercise plan for stroke sufferers who are experiencing weakness, stiffness, hemiparesis (one side weakness), or incoordination in their hand or hands.

When the author began working on the fundamentals that lead to what is now Handmaster Plus, I was mostly inspired to help athletes and musicians to train for proper grip as an aid to higher performance and injury prevention. The original focus was to challenge and change muscular strength and balance… at the time.

One day early in the new millennium, one of the author's senior patients reported that they had had a stroke. At that time, the *medium resistance* strength of Handmaster Plus was all that was produced.

The author had recently taken multiple complicated hand exercises and coupled them into one easy, quick and complete training invention. This new exercise allowed my patients that were athletes and musicians mostly at that time, but also some workers, gamers, and hobbyists to make the best use of their training time while at the same time maximizing strength, balance and performance. They all loved it. And the author was feeling pretty *puffy* about himself.

But could I help my senior patient who had just had a stroke? Turns out the answer was a quick and concrete, 'No.' She could open her hand and close her hand fully without resistance, but the medium strength sample was just too firm for her. I could not help her.

The author had been so focused on strength and balance training that I had not even considered the need for a softer recovery strength version of the device. A softer version was soon created so that stroke patients and anyone else needing complete and convenient recovery-focused exercise could experience the same benefits as the others.

The author would never forget the humbling of that day. Not only did I realize that my irresponsible naivety had left my beautiful senior patient over-promised and under-delivered (in fact, empty-handed), but it was also when I was first held to notice, *this device could help a lot of people.*

At the time, the author felt the absolute need to become a true hand exercise leader and to stand up for those left over-promised and under-delivered in their quest for proper hand and grip exercise, whether that be in training, injury-prevention or in post-treatment recovery environments. *No more irresponsible naivety.*

Regarding stroke recovery, what is the best way to aid stimulation in an effort to recover or improve on the use of their fingers, thumbs, hands, wrists, and forearms?

Here is what the author concludes so many years later after much thought, study, and experience: Recovery exercises must complete, efficient and affordable, respecting the design of nature and the capability of the individual. And in the case of stroke recovery, exercise must permit independency (if desired), and be fun, or *at least interesting*.

There are 3 peripheral nerves that carry signals to and from the hand muscles: the radial, ulnar and medial nerves. All of these nerves carry both sensory (sensation) and motor (action) nerve fibers between the brain and the body. It is essential that all peripheral nerves be stimulated *maximally* such that each neuromuscular pathway is habitually retrained after stroke injury.

As in the case in many hand and grip exercise environments, logo-ed squeeze balls and 'squeeze-only' grip items are common choices for stroke sufferers, but their choice has never been an informed one.

Review the Handmaster Plus exercises in Chapter 9. The HC/HO Exercise is a complete and efficient exercise for those patients that seek post-treatment recovering exercises following a stroke. The full closing of the hand stimulates the median and ulnar nerves, and the fully opening of the hand stimulates the radial nerve.

When stroke patients use this same exercise that also helps grip athletes and musicians, all peripheral nerves to all hand muscles are stimulated maximally. Plus, because the muscles are moving fully and

naturally, the stroke patient will gain maximal blood flow, keeping tissues as healthy as possible during recovery.

The soft strength Handmaster Plus ball and cord was made immediately after my patient blunder early on in Handmaster Plus development and has been used by stroke sufferers and other weaker, recovery-orientated users ever since.

Everyone benefits from full range of motion exercise. Athletes do. Musicians do. And so too do stroke sufferers. The only difference is the resistance.

I learned about peripheral nerve stimulation from caring about and *not helping* my stroke patient. I learned about grip muscle groups through caring about and helping my athlete and musician patients and friends. So many benefits arise from caring, committing to understand the body's design and then training folks accordingly.

Readers may wonder, 'What if a stroke sufferer cannot move their hands through full ROM's, what's the sense of adding resistance?

Depending on the evaluation of the therapist (rehabilitation nurse, PT, OT, recreational therapist, etc.) attending, the stroke sufferer can perform the exercise through whatever ROM they are able, even if not a full ROM. The design of the Handmaster Plus product will allow the user to move their hand through whatever ROM they are able to. Finger and thumb cords permit the product to stay on the patient's hand easily. The patient is independent through the exercise. The product will not fall. The resistance will still help to build neuromuscular tracts even if not through a full ROM and the patient can progress on their own speed.

The therapist may also choose to have the patient perform opening and closing of the hand without Handmaster Plus until they are ready for the soft strength resistance..

An exercise study by Kim and Yim in Korea using Digiflex and powerweb for handgrip, as well as spending time on a treadmill

concluded that, 'improving handgrip strength and walking speed had positive effects on cognitive function in patients with chronic stroke.[30]

The study also concludes the following: 'Future studies will need to investigate additional exercise patterns for cognitive improvement in patients with chronic stroke with impaired cognition, in terms of intensity, enjoyableness, exercise style, and ease of application[31].'

In another study, eleven participants were randomly assigned to a group first receiving four weeks of eccentric strength training and then four weeks of task-oriented strength training (EST-TOST) or vice versa (TOST-EST). Strength and upper limb function were administered with a hand-held dynamometer (HHD) and the Action Research Arm Test (ARAT) respectively.

'The results of this study show that a combination of eccentric and task-oriented strength training is an effective and feasible training method to increase function and strength in individuals with chronic stroke.'[32]

Exercise has been clearly shown to help stroke patients with cognitive function and strength.

Now let's circle back and address an earlier statement. For stroke patients a recovery exercise must be fun, or at least interesting. Notice that researchers Kim and Yim use the term *enjoyableness* when they refer to their suggested direction for future stroke and exercise related studies.

The author wholeheartedly agrees and suggests to therapists to encourage patients to watch (on television or computer or video) and react concurrently to while using Handmaster Plus. For example, they may have interest in sports such as basketball or baseball. Reacting to plays in the game can break any sense of monotony and stimulate creative imagination.

The author may venture into creating reactive media to enhance the enjoyment of the Handmaster Plus exercises.

When Handmaster Plus is used alone without additional media, the stroke patient will still enjoy the feedback of sensing full range of motion exercise through both hand closing and opening that they have likely never before experienced.

Patients can gain a feeling of independence as the ball and cord design ensures that the ball will never drop, making unattended care a reality. The patient may also be intrigued as they observe their own progress through each close and open repetition, as well as in monitoring their own progress from session to session.

Mirror Exercise

The Mirror Exercise is another option that can be performed as a post-treatment recovery exercise using Handmaster Plus.

The Mirror Exercise involves using a tabletop mirror to reflect the user's healthy hand performing the Handmaster Plus exercise through full ranges of motion of both the hand closing and opening against resistance (instead of using the stroke-recovery hand). This exercise creates the illusion that both hands are moving well.

This mirror protocol gives the user's brain the feedback that the stroke-recovery hand is healthy and functional, and thus stimulates neuromuscular pathways (via neuroplasticity) from the brain to adapt to the perceived event. It is a similar technique used to reduce phantom limb pain in amputees.

In July of 2018, the results of a review of 62 studies that compared mirror therapy with other interventions were published in the Cochrane Database of Systematic Reviews. Their conclusions were as follows.

'The results indicate evidence for the effectiveness of mirror therapy for improving upper extremity motor function, motor impairment, activities of daily living, and pain, at least as an adjunct to conventional rehabilitation for people after stroke.'[33]

The fundamentals of developing Great Hands are applicable directly to those who have suffered a stroke or are at high risk for

stroke. When we seek to train all hand muscles properly through full, natural ROMs to whatever capacity an individual is able, we automatically stimulate all peripheral neuromuscular pathways and maximize the circulation of healing blood and lymph fluids.

Recommended post-treatment recovery exercises for stroke patients using Handmaster Plus: 1) HO/HC

CHAPTER 12
GREAT HANDS AND LONGEVITY

A study was published in May of 2018 in the prestigious BMJ (British Journal of Medicine) that got the media's - and the world's – attention. That study is known as the UK Biobank grip strength study… and lead to headlines like these:

'Grip Strength Predicts Longevity!'

'Grip Strength Inversely Proportional to 'All Cause' Mortality!'

It was a prospective population based study that analyzed over 500,000 participants from the UK Biobank (The UK Biobank is a large bank of biological matter study started in 2006 in the UK used to observe genetic predisposition and environmental exposure to the development of disease). The objective was to investigate the association of grip strength with disease specific incidence and mortality and whether grip strength enhances the predictability of an established risk score.

They concluded: 'This study has shown that grip strength is strongly and inversely associated with all-cause mortality and incidence of and mortality from cardiovascular disease, respiratory disease, chronic obstructive pulmonary disease, all cancer, and subtypes of cancer, including colorectal, lung, and breast cancer, with associations being modestly stronger in the younger age groups.'[34]

The media was on it like kids on a birthday cake. *Grip strength inversely proportional to 'all cause' mortality?* That's pretty incredible stuff. And extremely relatable, as well as attention getting! Media outlets picked up the story of this research and ran - from local news & health shows, to major newspapers, and all the way to the Rachael Ray Show (i.e., incidentally she used a coiled 'squeeze-only' gripper as her prop!).

It was big-time. It was water cooler conversation and vital health care information. It was everywhere.

And then, Boom. It was gone. Like magic.

But 2018 wasn't the only time that this type of event had happened. It wasn't the first time that research directly relating grip strength to life longevity had made a splash in the media. Not by a long shot.

Another famous study published in The Lancet in May 0f 2015 made media waves for a brief time also. The Prospective Urban-Rural Epidemiology study (i.e. The PURE Study) was a large, longitudinal population study done in 17 countries involving over 140,000 people of varying incomes and sociocultural settings.

The interpretation of this study was as follows: 'This study suggests that measurement of grip strength is a simple, inexpensive risk-stratifying method for all-cause death, cardiovascular death, and cardiovascular disease.'[35]

Let's keep going. The 2006 Hertfordshire Cohort Study tested approximately 1500 men and 1400 women born in Hertfordshire, UK between 1931 and 1939 and still lived in the county. They used grip strength as one of their main metrics.

Their conclusions: 'Our findings suggest that lower grip strength is associated with reduced HRQoL (health-related quality of life) in older men and women. This does not appear to be explained by age, size, physical activity or co-morbidity and may reflect the link between sarcopaenia and generalized frailty. Individuals with sarcopaenia may benefit from interventions to improve muscle mass and strength before the onset of chronic disorders usually associated with impaired HRQoL.'[36]

Next up: A 25-year prospective cohort study (the Honolulu Heart Program) was published in 1999 in JAMA. It began in 1965 involving over 6000 Japanese-American men living on Oahu, Hawaii. All were all healthy at baseline. Altogether, 2259 men died over the follow-up

period and 3218 survivors participated in the disability assessment in 1991 through 1993.

Here's what they found: 'Among healthy 45- to 68-year-old men, hand grip strength was highly predictive of functional limitations and disability 25 years later. Good muscle strength in midlife may protect people from old age disability by providing a greater safety margin above the threshold of disability.'[37]

And we could go on and on with studies relating *poor grip strength* to *poor health.* The research is nearly endless there. 3839404142434445

The point is clear: Good grip strength – good. Bad grip strength – *not so good!*

The aforementioned 2018 BMJ UK Biobank study made comments regarding a possible explanation as to *why* grip-strength may predict health outcome, directing their attention at the specific benefits of muscle tissue itself: 'It (muscle) controls body movements, serves as the body's primary protein store and plays an important role in regulating blood sugar.'[46]

The author agrees that muscle tone throughout the body is a huge health advantage, but there is no suspicion that the specific role of the hand and grip muscles themselves lent any clue to this consistent and undisputed longevity link.

Why not?

There is an inherent assumption that a muscle is a muscle is a muscle, and that studies just happen to pick the hand muscles because they are likely the easiest to test and record. But the hand muscles *are unique* in their anatomical position and *are unique* in their role. There is still so much to be questioned and explored within this important topic.

And, alas, it is early in the *muscle = longevity* research era. We can all be happy knowing that something as simple as strengthening

our muscles will help us live longer. This is very good news indeed - just not news that sticks around long in the media.

The author has come to believe that there is much more to the story of muscles, and especially of healthy, balanced hand muscles in relation to advanced wellness, disease prevention and longevity. We have so much to learn and explore. Grip is an exciting area. And it has been dismissed in health care and fitness for far too long.

Hand muscles should never be viewed on their own. They are part in parcel of diverse neuromusculoskeletal (nerves, muscles, and bony structures) and vascular (blood and lymph) complexes that are vital in determining our life experience and, quite possibly, in extending our lives.

The hands have taught the author that muscles, together with all related tissues and systems that they affect, must be well understood. When muscles are understood and trained properly, we find out just how well we can perform.

Handgrip exercises have long been known in the research to lower blood pressure as well. That's a pretty big statement. High blood pressure (hypertension) has long been a leading risk factor for cardiovascular disease, the #1 *'ender of life'* in the USA.

A 2017 Study published in Current Hypertension Reports states that, 'Isometric handgrip (IHG) training is a simple intervention endorsed by the American Heart Association as a potential adjuvant BP-lowering treatment.'[47]

A 2014 study of 30 volunteers using dynamometer isometric contracting 3x/week for 10 weeks resulted in the following findings: 'There was a significant reduction in resting blood pressure following 10 weeks of exercise training. Both Systolic and Diastolic blood pressure reduced significantly. IHG (Isometric Handgrip) exercise training might be a simple, effective, inexpensive and non-pharmacological method in lowering blood pressure.'[48]

This is indeed major (and affordable) health news. And these studies use isometric contraction only. What would the results look

like if they exercised all of the hand muscles through full ranges of motion?

When the author began getting feedback from Handmaster Plus users in the early 2000's, I noticed an unexpected trend was beginning. The exercises were helping the targeted intent (i.e., balancing of muscles and improved function of the joints and structures being served), which made sense since I had used multiple devices before to accomplish similar hand trainings. I knew mostly what to expect. But I soon started getting regular feedback that patients who were using Handmaster Plus were *feeling better*. I was thrilled by this response, but only thought it to be due to better blood flow in the area, or maybe a general relief from the stress of their identified condition, or maybe just a placebo-type effect (i.e., it was all in their head; they wanted to feel better, so did).

My opinion changed greatly after 2 experiences: 1) thermography images were recorded in a 2017 comparison of the Handmaster Plus exercise to traditional 'squeeze-only' exercises, and 2) I came upon the work of UK osteopath, Dr. Raymond Perrin.

The thermography images from 2017 were previously presented in Chapter 5a (Grip Dilemmas of the Elbow (Core)). Please review, if necessary. These images made it clear that strengthening all 18 hand muscles through their full, natural ranges of motion with resistance elicited a dramatic circulation response within the upper extremity. Where exercise stimulates improved arterial blood flow, one can assume also that venous flow/drainage and lymphatic flow/drainage will be increased.

But that still didn't explain *feeling better*.

It was my mom who first introduced me to the work of Dr. Raymond Perrin, a UK osteopath who was doing groundbreaking clinical work specializing within a very difficult diagnosis: chronic fatigue syndrome (CFS), or myalgic encephalomyelitis (ME) as it is often called in the UK. My mom is a natural health nut as well (surprise, surprise!) and was excited about Dr. Perrin's focus on the health of his patient's lymphatic vessels and lymphatic ducts.

Seeing the video of Dr. Perrin moved the author into a full review the lymphatic system. It was a turning point that also lead me to a deeper study of the role of lymph drainage in regards to hand exercise. More new learning was required regarding how to best train the grip, the hands and the upper extremity.

It is quite sensible to postulate that when one completely trains the *kinetic chain of grip* (i.e., the 18 hand muscles as well as the 9 wrist support muscles), one is very likely to improve the lymphatic drainage of the upper extremity. We know via thermography that circulation is indeed improving during proper hand training which can only aid the movement of the lymphatic fluid.

The author now believes that complete hand and posture exercise improves upper extremity blood flow, which improves lymphatic flow, which in turn improves the function of the vital lymphatic ducts.[1]

Here's how and why that's important…

Refer to the '***Lymph Flow to Lymphatic Ducts'*** image and notice the path of flow for lymphatic fluid indicated by the black arrows. Note also the physical location of the lymphatic ducts (represented by stars) in relation to the upper arm.

The right lymphatic duct drains the right arm, right upper torso, and right side of the brain, head and neck. The thoracic duct (the left lymphatic duct) drains the rest of the body's lymphatic fluid. Lymphatic fluid, carrying large molecule waste and toxins, passes back into the venous system via these ducts, for elimination.

When hand and grip muscles are thoroughly exercised, circulation is increased as is both venous blood and lymphatic fluid flow back towards the heart, due to increased pressure in the tissues.

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[1] Visit http://www.handmasterplus.com/exercises to view the advanced PLC (Posture, Lymph, Circulation) Exercise to stimulate posture and lymph flow.

The lymphatic fluid passes (quickly or, at least, eventually) through the lymph ducts into the subclavian vein and back into the venous system.

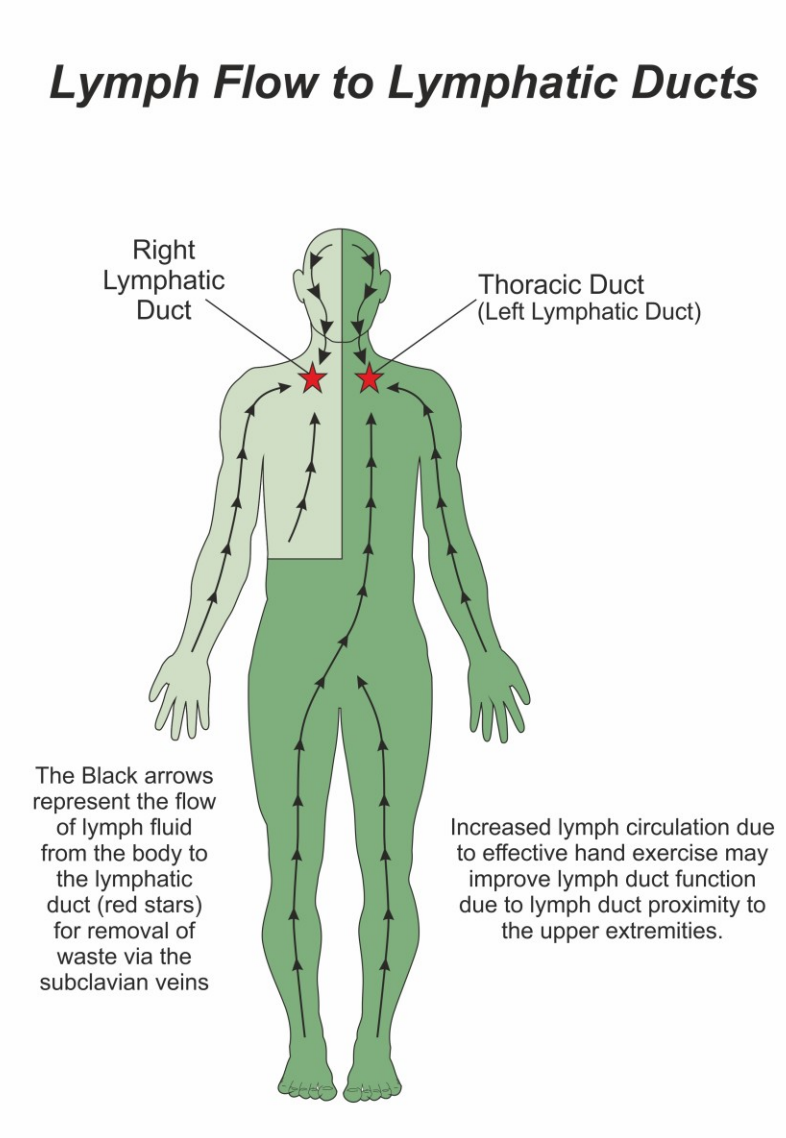

Fig. 31 General Flow of The Lymphatic System

When the lymphatic ducts are working more efficiently, the body is better at removing toxins. That means a healthier body and brain. Think of the implications.

The proximity of the upper arms to the lymphatic ducts may someday be proven to be a very important health factor. Hand exercise very likely improves the function of the lymphatic ducts.

That would explain Handmaster Plus users *feeling better* as well as the many grip-strength and longevity correlations. And if fluid were moving better, wouldn't it stand to reason that blood pressure would be reduced?

The reader should know that this postulate has not been proven by research at this time. In fact, mainstream research regarding the functioning of the lymphatic system has only recently gained momentum. It wasn't until 2015 that researchers published information as to the existence of a lymphatic system in the brain.[49]

Two studies may pique the reader's interest regarding further hand strength and the brain, even though correlation to lymphatic drainage is not specifically noted in either. The general point is clear and proven though: hand exercise affects brain health.

Study #1: Forty older people with dementia were recruited and randomly allocated into an experimental group and a control group, each with 20 people. The control group received routine nursing care. In addition to this, the experimental group received 25-minutes of passive finger exercises every day for 12 weeks. The health outcomes were measured.

The findings: 'Passive finger exercises can be integrated into physical exercise programs for older people with dementia to improve their urinary control, defecation function, and ADL (activities of daily living).'[50]

Author's comment: Finger exercises affecting functions controlled by the brain as specific as urinating and defecating, and as general as activities of daily living? Wow. How are we not suggesting simple hand exercise for every senior (and every senior in every

senior home) as a daily health habit? It is so simple, so obvious, and so affordable. Hand exercise = Improved quality of life.

Study #2: Cross-sectional, community-based data on individuals aged 50 years or older from the World Health Organization's Study on Global Ageing and Adult Health were analyzed to evaluate grip strength and MCI (mild cognitive impairment).

Conclusions: **'**Muscular weakness may provide a clinically useful indicator of MCI risk. Increasing our understanding of the connection between muscular and cognitive function could ultimately lead to the development and broader implementation of resistance training interventions targeting both physical and cognitive health.'[51]

Author's comment: Simple exercise correlated with physical and cognitive health? Again, wow. Simple observation and leadership can help our seniors (and everyone) to immediately and dramatically lead healthier lives.

The brain has indeed been clearly and consistently proven stimulated by grip and finger exercises. Do hand exercises stimulate the brain *via the nervous system*? Or does *the lymphatic system* clear the brain of toxins better when hands are fully exercised, allowing it to function well? Or is the brain just better when the *overall strength* of a person is greater? Or, is it all of the above?

The author believes the answer is likely all of the above, and more. When one understands how something (hands and grip) works, designing a solution (an exercise product) for a very solvable and important problem (hand and grip imbalance) becomes structured. Once one knows the truth, one cannot sit on the fence. But this information must be passed forward.

The author made sure that Handmaster Plus exercises were through full, natural, 3-dimensional ROMs (ranges of motion) in order to stimulate all neuromuscular pathways from brain to muscle and back. Full ROM exercise means that the muscles, tendons, ligaments and joint surfaces 'ask' the brain for full blood flow and lymphatic drainage. Not only is that good for the stability of the

fingers, thumbs, hands, wrist, carpal tunnels, forearms and elbows around the world, it appears to be good for health in general.

To see the studies that come out again and again (I've only presented a few in this brief chapter) about grip strength, health and longevity is fantastic and does not fully surprise the author. Your hand muscles and grip are *that important*, but even still, proper grip fundamentals are being ignored in every grip market.

Worse than that, hand exercise in general is being ignored. The author intends to change that.

The media historically will not dig deep into this subject of hand and grip strength. The stories of hand research flash and disappear every few years. But your health doesn't. You have to take hand and grip strength training on yourself if you expect to reap all of the benefits.

Hopefully this chapter and this book will move readers enough to take care of their own grip strength and open up their hearts and minds to tell others. Health is not a game. It is a reality. Understand grip, take good care of it and benefit for a long time. Ignore it and you're on your own.

Hand exercise is being ignored because it is simply misunderstood. 'S*queeze-only'* grippers are historically the devices of choice, akin to training hip flexor muscles for posture. In traditional grip training, many muscles are being omitted and the healing benefits are just not dramatic and consistent enough. The body is a self-healing entity, but it won't heal fully what isn't being utilized fully. How much could full kinetic chain of grip exercise help the health of the masses?

More research must and will be done regarding hand and grip strength in relation to health, and all reasonable hypotheses must be tested. To date, the correlation between grip strength and health and longevity cannot be explained in detail. As we advanced our understanding of the hand muscles and grip strength training, and as

research evolves, the mystery of grip strength and longevity will fully unravel.

There appears to be an abundance of data hidden in plain sight that supports the importance of grip muscle health and the benefit of attaining and maintaining a strong and balanced *kinetic chain of grip*. Folks with good hands live longer. Folks with weak hands develop more disease conditions. What would be the health of folks with Great Hands?

Did strong hand muscles create these research outcomes? Or are strong muscles throughout the body responsible? Both make sense to the author. And, as the author wishes to continue to be healthy for a long life, I'll continue with both until the research catches up and gives a clear answer.

I once overheard a gentleman in a grocery store speaking to a check out clerk in Langley, BC, Canada. The man said that he was 100, and was turning 101 in January (it was November of 2019). He was as sharp as a tack and looked like he was in his 80's.

I asked him what his secret was for a long and healthy life. He reflected for a moment, looked up and said quietly, "I wake up positive every morning."

That's pretty good longevity advice as well.

CHAPTER 13
GREAT HANDS FOR SPORTS

There are many pursuits that benefit from developing Great Hands via proper hand exercise. The author will start with Sports because that is where all the basic information was obtained and observed in the genesis of creating and developing Handmaster Plus and the resultant exercises in the book.

When I begin doing sEMGs (i.e. surface Electromyography) on grip muscles back in the early 2000's, most of my tests were on athletes because sports performance was my core background and passion. Let's look in more detail at sports that will and have benefitted greatly from adopting proper hand exercise into their training regiment. Incidentally, in most of these sports to follow, even to the current day, proper hand exercise may be omitted. There is indeed room for improved personal and/or team performance once proper grip training is brought to the forefront of the consciousness of both athlete and trainer.

Handmaster Plus exercises were designed specifically for users who are serious but busy and do not have time to waste. They are ideal for complete and convenient training, warm-up and warm-down for the athlete.

Golf

Handmaster Plus was developed most specifically through the constant observation of grip imbalances that resulted in injuries to amateur and professional golfers. The original college project that peaked my interest in grip (i.e. compare tennis elbow versus golfers elbow) has been brought up many times in the book. That report was the genesis of my suspicions and observations of imbalance in a vast array of grip athletes. It was my first look into the omission of so much as even the consideration of the balance of the grip muscles (i.e., the 9 hand closing muscles, the 9 hand opening muscles, and the

additional forearm muscles that support the wrist in ideal grip positions). It is an omission so great that one might wonder how it could ever have occurred. I have wondered the same nearly every day since the mid 1990's. But this oversight or under appreciation for the maintenance of constant strength, balance and circulation of the diverse grip muscles also creates great opportunity.

In sporting worlds, where the evolution of a competitive edge through training narrows constantly, opportunity for performance improvement through grip improvement is currently wide open. And, as you now know, grip health is hugely relevant to the performance of the fingers, thumbs, hands, wrists, carpal tunnels and elbows.

The final convincing evidence I needed to confirm that poor (or no) hand muscle training was leading to performance problems in grip activities came when I chased my own dream to become a professional golfer. I was an insider. I saw it all. Grip related injuries are rampant in golf; and still are to this day.

Before that time, in private practice, many finger, thumb, hand, wrist, carpal tunnel and elbow problems merely *seemed* to stem from the imbalance of the grip related structures. Once I travelled on mini tours throughout the United States and Canada, I became convinced. What I saw on the mini tours was shocking and often career threatening. It shook me into a devotion to service to myself and to other golfers, and eventually to other sports endeavours, music endeavours, workplace environments, and to grip in general.

As you've learned from reading this book, observing grip injuries also opened me up to consider the general health implications that proper grip training offers *to everyone* by eliciting maximum lymphatic drainage via the lymph ducts that happen to be located just proximal to the upper arms. It turns out that upper extremity circulation may be a key health factor that has been passed over for decades, maybe centuries.

The main injuries that I saw like clockwork from professional golfers were at the wrist and elbow. As mentioned in Chapters 5 and 6, golfers are constantly exposed to both static and active (mostly

Grip & Strike) grip dilemmas at the wrist and elbow. Review Chapter 2 to solidify and visualize how many grip and grip stabilizer muscles cross both the wrist and elbow. When strength, balance and circulation to these key muscles are ignored, golfers are at high risk for performance limitation and injury. There are endless resources and discussions about how to grip the golf club, but very little is known in the golf world about the muscles that do so.

The main performance advantages to golfers of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Ease of control of the golf club without conscious grip effort (i.e., light grip pressure for control is attained easily),
2. Ease of creating club head speed without conscious grip effort (i.e. light grip pressure for power is attained easily),
3. Better range of motion allows the golfer to attain strong mechanical swing positions at the wrist,
4. Access to strong grip strength when needed (i.e., limited swing situations (under tree), high rough, etc.),
5. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries (both static and active) common in golf,
6. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint surfaces), as well as general health.

Recommended training exercises for golfers using Handmaster Plus: 1) HC/HO 2) Figure 8 Exercise

Tennis & Racquet Sports

Tennis (and racquet sports) are similar in mechanics and injury risk to golf in that they are highly repetitive and exposed to many constant grip dilemmas: 1) *static gripping* (in physical training, practise and competition), 2) *'grip & strike'* 3) *'grip & stretch'* and 4) *'grip & rotate.'* Tennis is indeed one of the most highly exposed

activities for wrist and elbow injuries, including both tennis and golfer's elbow.

Proper grip and grip training of course plays a huge underlying role in these injuries and imbalances. As in golf, much discussion and instruction is alive and well regarding *how* to grip the tennis racquet (and other racquets), but little is known or discussed about the muscles that do so.

The stress and repetition of the basic tennis strokes create a huge need to understand not only the interplay of the 18 muscles of the hand that grip the racquet, but also the muscles of the forearm that contract to support the various wrist positions. These groups of muscles are relied upon repetitively in tennis and other racquet sports, yet are spotty in training and research.

Handmaster Plus is used by tennis players and therapists to train tennis (and racquet sports) grip muscles properly through full, natural ranges of motion with proper consideration to the mechanics of the kinetic chain of grip. The result is that the tennis (and racquet sport) athlete remains strong, balanced, and healthy to address the demands of their sport and reduce their risk of injury.

The main performance advantages to tennis athletes (and other racquet athletes) of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Ease of control of the racquet without conscious grip effort (i.e., proper grip pressure for control attained without restricting forearm & shoulder),

2. Ease of creating racquet speed without conscious grip effort (i.e., proper grip pressure for power is attained without restricting forearm & shoulder),

3. Better range of motion allows better mechanical positions at the wrist,

4. Access to strong grip strength when needed.

5. Reduced exposure to repetitive finger, thumb, hand, wrist, carpal tunnel and elbow injuries (both static and active) common in tennis,

6. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint surfaces), as well as general health.

Recommended tennis training exercises using Handmaster Plus: 1) HC/HO 2) Figure 8 Exercise

Football

Great Hands are an asset throughout all positions in football. The BC Lions of the Canadian Football League (CFL) participated in our first set of football specific sEMG muscle patterns.

Understanding the kinetic chain of grip can give a competitive advantage for tackling. Strong, stable hands, wrist and forearms can be the difference between a made or broken tackle.

Throwing mechanics are also front and center. Quarterbacks require strength, speed, stretch, flexibility and healthy circulation throughout the hand, wrist, forearm and elbow to perform at an elite level. Weight training that involves repetitive gripping can lead to overuse and grip muscle imbalances, especially at the lateral forearm. Repeated throwing exposes QB's to repetition elbow injuries, especially when proper grip training has been omitted. We reviewed earlier that throwers are exposed to injury before, during and after (follow through) each throw.

Proper physical catching mechanics will give football receivers a competitive edge. When the kinetic chain of grip is strong and stable, the receiver has access to maximum hand speed, stretch, strength and circulation. Performance is maximized.

As in most contact sports, football players are under a constant barrage from injuries. Football players are commonly exposed to finger, thumb, hand and wrist injuries due to: a) player to player contact (hits, tackles and blocks), b) hand to ground contact (falls,

hits, tackles and blocks), 3) repetitive throwing (QB's), 4) football to hands (receivers). Jams, sprains, strains, dislocations, and fractures are common. Proper post-treatment recovery exercise principles improve circulation and support fast, complete healing which minimizes the risk of the injuries lingering or reoccurring.

For training and post-treatment recovery, many NFL teams use Handmaster Plus in their training rooms.

The main performance advantages to football athletes of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Grip stability and access to strong grip strength when needed for tackles.

2. Better range of motion allows superior mechanical positions at the wrist (set) and elbow (follow through), as well as strength and hand spread (range of motion) to hold and throw the football with control,

3. Quicker, stronger, wider stretch for hand, fingers and thumbs to catch the football.

4. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries (both static and active) common in football,

5. Shorter recovery times from hand, wrist, finger and thumb jams, sprains, strains and dislocations when they occur (via maximized strength, balance and circulation),

6. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint surfaces), and benefits general health.

Recommended football training exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip

Basketball

As mentioned previously, the first time I saw Chris Mullen shoot a jump shot, I realized that shooting a basketball is indeed an art. But it is also a science.

Great Hands for basketball extends proper shooting mechanics into the wrist and forearm. When a basketball player weight trains, they are likely to be constantly gripping weights in their workouts. Thus, they may unknowingly develop dominant finger flexor muscles on the front of the hand, wrist and forearm vs. the finger extensor muscles on the back. We have discussed this imbalance issue at length throughout the book.

When shooting a basketball, it is beneficial to create healthy wrist angle backwards during the 'set' portion of the basketball shot. This angle allows the player to effortlessly *preload* power, height, and backspin as they load to shoot the basketball. If the finger flexor muscles are shortened, tight, and dominant, this wrist set angle will be small, and that can be a hindrance to becoming a consistent shooter.

Additionally, Great Hands are an advantage for ball handling, ball control rebounding and battles for possession in basketball. Adherence to *proper kinetic chain of grip* principles provides the basketball player with a competitive edge.

Basketball players are constantly ailed by finger, thumb, hand and wrist injuries because of regular contact between: a) hands and floor (i.e., falls and loose ball battles), b) player and player (rebounding, loose ball and possession battles), and 3) basketball and hands (passes, rebounds, and blocks). Jams, sprains, strains, dislocations, and fractures are commonplace in basketball. Proper post-treatment recovery exercise principles improve circulation and support fast, complete healing which minimizes the risk that injuries will linger or reoccur.

For training and recovery, many NBA teams use Handmaster Plus in their training rooms.

Basketball is a very physical sport. Great Hands are a must to prepare the serious basketball athlete for competition. The main

performance advantages to basketball athletes of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Better range of motion allows superior mechanical shooting positions at the wrist (setting the basketball shot) and elbow (follow through), as well as strength and hand stretch to grab, grip, shoot and pass the basketball with control,

2. Reduced exposure to finger, thumb, hand, wrist, and elbow injuries (both static and active) common in basketball,

3. Shorter recovery times from hand, wrist, finger and thumb jams, sprains, strains, dislocations and fractures when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended basketball training exercises using Handmaster Plus: All: 1) HC/HO, 2) Figure 8 Exercise, 3) Lateral Forearm Exercise, 4) Finger Tip Grip

Baseball

Pitchers have been the main baseball users of Handmaster Plus because the demand for a healthy *kinetic chain to grip* for various pitches. The author believes that grip imbalances and overuse have been a contributive cause of rampant pitching injuries at the elbow, yet grip training has been overlooked as causative. *Grip and stretch* and *grip and rotate* dilemmas at the elbow mean that pitchers must prepare the elbow as well as possible for strength, balance and circulation, as well as for core ball control and grip for different pitch types.

Position players benefit from speed, strength, stamina, stretch and healthy circulation to gain a competitive defensive edge in glove performance as well as throwing. Infielders should prepare completely to have the best chance of making a play with speed and strength on any live ball. Catchers are challenged physical by hours of

holding up a target and reacting regularly to pitch locations and various defensive demands. Outfielders must especially prepare their throwing arm mechanics.

All batters benefit from a properly prepared *kinetic chain of grip* that allows them maximum hand, wrist and forearm speed, strength, and range of motion to react decisively to various pitches and pitch locations at speed.

Baseball players are commonly ailed by elbow injuries (pitching, throwing, repetitive training, etc.), and by finger, thumb, hand and wrist injuries because of regular contact between: a) ball and player (hit batters and defensive plays), and b) hands and ground (running, stealing bases, defensive plays, etc.).

The main performance advantages to baseball athletes of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Better performance mechanics for pitchers to grip and throw, based on proper kinetic chain of grip principles,
2. Better throwing mechanics for outfielders, infielders and catchers,
3. Reduced injury risk to all throwing positions
4. Better hand speed, strength and stretch for defensive glove mechanics
5. Shorter recovery times from elbow, hand, wrist, finger and thumb injuires when they occur (via maximized strength, balance and circulation),
6. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended baseball training exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip (for pitchers)

Hockey

All position players gain a clear competitive from Great Hands in hockey.

Centers gain an advantage on face-offs, a key puck-possession aspect of the game.

All forwards and defensemen gain a competitive advantage by acquiring stronger, faster, more stable, and more healthy hand, wrist, and forearm muscles that are key in puck handling, passing, shooting and in puck possession battles.

Goalies benefit from speed, strength, stamina, stretch and healthy circulation to gain a competitive defensive edge in catching glove and blocker performance, as well in puck handling to aid defensive zone and team transition play.

Hockey players are commonly ailed by repetitive stress related elbow and wrist injuries (repetitive training, active *'grip and strike'* and *'grip and repetition'* dilemmas), and by finger, thumb, and hand injuries due to regular contact between: a) puck and player (hit by puck), b) stick and player (slashing), c) player and player (body checks, fights, and incidental contact).

For training and post-treatment recovery, many NHL teams use Handmaster Plus in their training rooms.

The main performance advantages to hockey athletes of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Better performance mechanics for face-offs, puck handling, shooting and puck battles, based on proper *kinetic chain of grip* principles,

2. Better catching, blocker and stick-handling mechanics for goaltenders,

3. Reduced injury risk for repetitive grip related injuries at the hand, wrist and elbow.

4. Shorter recovery times from elbow, wrist, hand, finger and thumb injuries when they occur (via maximized strength, balance and circulation),

5. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended hockey training exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise

To follow are many other sports and sports categories that have been observed to be vastly affected by proper training protocols that adhere to proper *kinetic chain of grip* training principles, over the last 20 years.

Volleyball

The main performance advantages to volleyball athletes for having strong, healthy and balanced finger, thumb, hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Better range of motion allows superior mechanical positions at the wrist (volleyball serve or hit) and elbow (follow through), as well as healthy, stable fingers, thumbs and hands for controlled passing of the volleyball,

2. Reduced exposure to finger, thumb, hand, wrist, and elbow injuries common in volleyball,

3. Shorter recovery times from finger, thumb, hand, wrist, and elbow injuries such as jams, sprains, strains, dislocations and fractures when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended volleyball training exercises using Handmaster Plus: All: 1) HC/HO 2) Figure 8 Exercise, 3) Lateral Forearm Exercise, 4) Finger Tip Grip

Climbing

Please refer to our brand partner, Metolius Climbing (www.metoliusclimbing.com) in Bend OR, USA, who have been educating and supplying climbers around the world with proper finger, thumb, hand, wrist, carpal tunnel, forearm and elbow training (based on the proper *kinetic chain of grip* principles) for over 15 years.

The main performance advantages to climbers of having strong, healthy and balanced hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Access to strength, balance, stability, stretch and stamina to grip and grip support muscles, resulting in maximum climbing performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel, and elbow injuries that are common in climbing,

3. Shorter recovery times from finger, thumb, hand, wrist, carpal tunnel, and elbow injuries when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended climbing exercises using Handmaster Plus: 1) HC/HO 2) Figure 8 Exercise, 3) Finger Tip Grip

Cricket

Cricket players are commonly ailed by elbow and wrist injuries (bowlers, throwing, repetitive training, etc.), and by finger, thumb, hand and wrist injuries because of regular contact between: a) ball and player (hit batsmen and defensive plays), and b) hands and ground (defensive plays, etc).

The main performance advantages to cricket athletes of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1. Better performance mechanics for bowlers to grip, spin, and throw based on proper *kinetic chain of grip* principles,

2. Better performance mechanics for batsmen (speed, stamina, ease of grip strength)

3. Better hand speed, strength and stretch for defensive catch mechanics

4. Shorter recovery times from elbow, hand, wrist, finger and thumb injuries when they occur (via maximized strength, balance and circulation),

5. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended cricket training exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip (for bowlers)

Gymnastics

The main performance advantages to gymnasts for having strong, healthy and balanced hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Access to strength, balance, stability, stretch and stamina to grip muscles, resulting in maximum performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries that are common in gymnastics,

3. Shorter recovery times from finger, thumb, hand, wrist, and elbow injuries when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended exercises for gymnasts using Handmaster Plus: 1) HC/HO 2) Figure 8 Exercise

Lacrosse

The main performance advantages to lacrosse athletes for having strong, healthy and balanced hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Better performance mechanics for catching, ball handling, shooting and ball battles, based on proper *kinetic chain of grip* principles,

2. Reduced injury risk for repetitive grip related injuries at the fingers, thumb, hand, wrist and elbow.

3. Shorter recovery times from finger, thumb, hand, wrist and elbow injuries when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended lacrosse training exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise

Combat Sports (MMA, boxing, karate, etc.)

Combat sports is a wide category, but speaks to combat sports where: 1) gripping and grasping is a key central focus and proper *kinetic chain of grip* training can ensure the athlete has access to maximum strength, speed and stamina of grip and grip support

muscles, and/or 2) where striking and protecting may place the fingers, thumb, hand, wrist, and elbow at risk of jamming, sprain, strain, dislocation and fracture. Thus, injury prevention and efficient recovery are in constant demand.

The main performance advantages to combat athletes for having strong, healthy and balanced hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Access to strength, stability, stretch and stamina to grip and grip support muscles, resulting in maximum grip performance.

2. Reduced exposure to finger, thumb, hand, wrist, and elbow injuries that are common in combat sports,

3. Shorter recovery times from finger, thumb, hand, wrist, and elbow injuries when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended exercises for combat athletes using Handmaster Plus: 1) HC/HO 2) Figure 8 Exercise, 3) Finger Tip Grip

Motor & Extreme Grip Sports (Formula 1, Motocross, Jet-ski, BMX, Windsurfing, Kite-Sailing, etc.)

These categories of sports are dominated by *static repetitive gripping*, *grip & rotate* and *grip & repetition* dilemmas. When proper *kinetic chain of grip* principles are introduced into the training of these individual athletes, grip performance is maximized, injuries are reduced and careers are extended.

The main performance advantages to motor and extreme grip athletes for having strong, healthy and balanced hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Maximum strength, balance and stamina to grip and grip support muscles, resulting in maximum grip performance.

2. Reduced exposure to repetitive finger, thumb, hand, wrist, carpal tunnel and elbow injuries,

3. Shorter recovery times from finger, thumb, hand, wrist, and elbow injuries when they occur (via maximized strength, balance and circulation recovery),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended Handmaster Plus exercises for motor and extreme grip sport athletes: 1) HC/HO 2) Figure 8 Exercise

Paddling Sports (Rowing, Canoe, Kayak, SUP, dragon boat, etc.)

Paddle sports are another category of sports dominated by RSI's, especially *repetitive gripping* and *grip and repetition* dilemmas. Elbow injuries (especially tennis elbow) is common among paddle sport athletes. When proper *kinetic chain of grip* principles are introduced into training, grip performance is maximized and injuries are reduced. In many cases, paddling sports are enjoyed competitively and ensure physical fitness and healthy outdoor habits from youth to advanced ages.

The main performance advantages to paddle sport athletes for having strong, healthy and balanced hand, wrist and elbow muscles (i.e., Great Hands) are:

1. Ease of control of the paddle without conscious grip effort (i.e., proper grip pressure for control attained without restricting forearm & shoulder),

2. Reduced exposure to repetitive finger, thumb, hand, wrist, and elbow injuries,

3. Shorter recovery times from finger, thumb, hand, wrist, and elbow injuries when they occur (via maximized strength, balance and circulation),

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended Handmaster Plus exercises for paddling athletes: 1) HC/HO 2) Figure 8 Exercise

CHAPTER 14
GREAT HANDS FOR MUSIC

The author's second love after sports is music. I've enjoyed working with musicians (both professional and amateur), watching musicians play and learning guitar myself. And who doesn't love music? Our world needs more good music. It enriches the soul. Unfortunately, playing music is a repetitive motion nightmare. For musicians, it's nearly impossible to stay strong and balanced.

In the early 2000's, I began to notice that the same repetitive grip injuries that were prominent in athletes were also affecting musicians (finger, thumb, hand, wrist, carpal tunnel, forearm, elbow). I also noticed that the music marketplace offered the same 'squeeze-only' hand exercise items as their only grip training solutions. Furthermore, musicians had the same mentality as athletes did in regard to training the hand and grip muscles: They either: 1) did nothing, or 2) used a 'squeeze-only' trainer.

Playing music at the highest level is both an art form and a science. All musicians are passionate about their art. And most musicians know their instrument and its accessories inside and out. But I rarely meet a musician that understands his or her grip muscles. The good news is that the majority of musicians are eager to learn and eager to get better. The author has worked passionately within the music marketplace to educate musicians and teachers alike; and to make this vital training complete and convenient for any musician. Now musicians can easily stay strong and healthy, and focus on their craft.

All musicians must understand 3 simple concepts in order to have Great Hands:

1. Strengthen all 18 hand muscles through full natural opening and closing.

2. Strengthen all of the supportive muscles of the wrist and forearm.

3. Maintain healthy circulation by warming up, cooling down and training regularly.

The result is:

1. Maximum speed, stretch, strength, balance and stamina

2. Maximum circulation

3. Maximum injury prevention

Musicians, let's remind ourselves of the *kinetic chain of grip* (presented in Chapter 3 – How Grip Works) regularly and then commit to building and maintaining Great Hands for great performance.

Handmaster Plus exercises were designed specifically for users who are serious about music, but cannot waste time. They are ideal for complete and convenient training of all hand and grip related structures. Handmaster Plus is also portable and can be utilized for convenient warm-up and cool-down purposes to reduce lactic acid build up and ensure maximum circulation.

Handmaster Plus is used by professional musicians around the world.

Each instrument poses it's own imbalance tendencies, but all musicians must prioritize continued health, balance and stability. Musical pursuits are separated below to highlight unique tendencies and further learn about the challenges to Great Hands.

Guitar & Bass

When the author first entered the music market, guitar players seemed to be the most convinced about their need for using a 'squeeze-only' hand exercise device. Their mentality seemed to be: '… playing guitar involves repetitive gripping, therefore I will repetitively grip in my training.'

When I first worked with guitar players individually, I asked them to compare their posture approach to their hand strengthening approach.

The conversation goes like this: 'Your guitar posture requires some degree of rounding of the body to be able to hold the guitar neck and strum the strings. Would it makes sense to strengthen or round your posture ***more*** during training to better prepare your body ***better*** to play guitar?' Of course not. That concept would lead to more imbalance, or further poor posture.

The same is true for strengthening the hands. Gripping during guitar performance is of course completely necessary, but creates imbalance between the muscles that close the hand and open the hand. That grip imbalance (as we know) can lead to instability of the fingers, thumbs, hand, wrist, carpal tunnel and elbow.

We can never solve a repetitive grip imbalance problem with more repetitive gripping.

Guitar players and bass players are classic example of repetitive grippers and flexors. They flex their fingers, thumbs and wrists (along with other wrist motions) repetitively in order to play. Once a guitar player learns how grip works, they are better able to understand what type of training helps them to play faster, stronger and longer. In turn, they become clear how to strengthen the hand, wrist and forearm muscles to avoid the many acute and chronic problems that are ever present among guitar players.

Guitarists are commonly stricken with finger, thumb, wrist and elbow tendonitis, carpal tunnel syndrome, cubital tunnel syndrome, cramping and circulation issues, and arthritis.

The main advantages for guitarists of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) is:

1. Maximum speed, strength, stretch and stamina of fingers, thumb, hand, wrist and forearm for maximum performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among guitarists,

3. Maximum blood flow to avoid cramping and fatigue during performance,

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended guitar exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip

Piano & Keyboards

Piano and keyboard players are unique in their exposure to injury and performance challenge as they operate inherently in a 'palm-down' position. We've spoken about this position many times throughout the book. The 'palm-down' position creates a *'double stress'* for the finger, thumb, and wrist extensor muscles, in that these muscles must: 1) support the finger and thumb flexor muscles when striking the keys (i.e., kinetic chain), and also 2) hold the fingers, thumbs, and hands *'up'* against gravity. Wherever we see a 'palm-down' position of the hands, we commonly see elbow and wrist overuse injuries and performance challenges. And we see more need to understand and train these support muscles properly.

Piano and keyboard players also face ergonomic positioning and technique challenges related to common wrist and finger/thumb positions. Carpal tunnel syndrome and tennis elbow are very real chronic problems within this music pursuit when proper hand and wrist training is omitted or is misunderstood.

For these reasons piano and keyboard musicians must develop healthy hand support, opening and spreading muscles to maximize performance potential and offset inherent injury risk.

A proper understanding of Chapter 3 - How Grip Works will be of great benefit to piano and keyboard players. Review regularly.

The main advantages for pianists and keyboard players for having strong, healthy and balanced hand and grip support muscles (i.e., Great Hands) is:

1. Effortless speed, control, stretch and stamina of fingers, thumb, hand, wrist and forearm for maximum performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among piano and keyboard players,

3. Maximum blood flow to avoid cramping and fatigue during performance,

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended pianist/keyboard exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip

Violin & Strings

Though it may not seem obvious upon first glance, the violin musician is specifically exposed to various repetitive muscle overuse, imbalance and injury conditions at the fingers, thumb, hand, wrist, carpal tunnel and elbow.

The violin player allows us an opportunity to discuss the concepts of the *'finger-down'* finger position and the *'palm-down'* hand position.

Violin players uniquely perform in a 'fingers-down' position with the fretting hand and a 'palm-down' position with the bow hand. In essence, a *'double stress'* situation is inherent in both hands in the following manner…

A) Fret Hand: The finger support (i.e., extensor) muscles contract *'doubly'* to 1) support the action of the finger flexor muscles in pressing the strings, and 2) to hold the fingers *'up'* against gravity,

AND,

B) Bow Hand: The finger and wrist support (i.e., extensor) muscles contract *'doubly'* to 1) support the action of the finger flexor muscles in gripping the bow, and 2) to hold the fingers and wrist *'up'* against gravity.

Other challenges to the health and balance of hand, wrist and forearm muscles of the violinist are: 1) repetitive flexion and pronation demands of the fretting wrist, and 2) repetitive motions of the bow handling wrist.

These repetitive motions are not pointed out to strike fear into the minds of violin players, but a reminder to create a plan to offset the inherent imbalances within the musical pursuit. The Figure 8 Exercise in Chapter 9 is especially beneficial for violinists to maintain the health, balance and circulation of the hand, wrist and forearm structures.

The author will not make comment regarding other string instruments but encourages all string musicians and teachers to be consciously aware of the non-neutral positions of the fingers, thumb, hand, wrist, carpal tunnel, forearm and elbow demanded during play. Much physical research could be done about each unique music pursuit, but the solution is the same: complete balance training.

The main advantages for violin players of having strong, healthy and balanced hand and grip support muscles (i.e., Great Hands) is:

1. Maximum speed, control, stretch and stamina of fingers, thumb, hand, wrist and forearm for maximum performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among violinists,

3. Maximum blood flow to avoid cramping and fatigue during performance,

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended violin exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip

Trumpet & Wind

Wind instruments are another opportunity to reflect upon what we have learned about the position of the fingers, thumbs, hands and wrists in relation to the potential for overuse, imbalance and injury.

Trumpet and cornet players specifically face a 'finger-down' finger position challenge inherently in their craft. The finger extensor muscles contract *'doubly'* to: 1) support the action of the finger flexor muscles in pressing the valves (one hand), and 2) to hold the fingers *'up'* against gravity (both hands).

Other wind instruments face a similar 'finger-down' finger position challenge such as flute, clarinet, recorder and oboe.

All wind instruments expose musicians to repetitive hand, wrist and forearm actions and thus demand proper understanding and a solution for healthy training.

The main advantages for trumpet players of having strong, healthy and balanced hand and grip support muscles (i.e., Great Hands) is:

1. Maximum speed, control, stretch and stamina of fingers, thumb, hand, wrist and forearm for maximum performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among violinists,

3. Maximum blood flow to avoid cramping and fatigue during performance,

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended trumpet exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip

Drums, Handbells & Percussion

Drums allow us an opportunity to discuss the concept of a *'thumb-down'* thumb position. Thumb extensor muscles may contract *'doubly'* to 1) support the action of the thumb flexor muscles in gripping the stick, and 2) to hold the thumb *'up'* against gravity.

Drummers repetitively grip the drumstick with the thumb facing down and lift the stick in preparation for each strike using a radial deviation motion of the wrist. The lift of the stick requires repetitive contraction of the radial deviation muscles of the wrist (ECR (extensor carpi radialis) and FCR (flexor carpi radialis)).

The drum strike itself is a *grip and strike* dilemma at the thumb, wrist and elbow as the grip muscle are contracted to hold the stick when the strike occurs.

Remember also that the drumstick is a small item compared to the hand, so there is concern that the small finger grip muscles are working hard for long periods of time without rest.

For all of the reasons above, it is not unusual to see drummers suffer from wrist and thumb and wrist tendonitis, DeQuervain's tenosynovitis, carpal tunnel syndrome and arthritis.

Handbell and other percussion musicians commonly see similar injuries due to the motion of thumb and wrist (while gripping).

Drummers and percussionists must maintain the health, balance and stability of these joints and tissues by using proper and complete hand exercise in warm-up, cool-down and regular training to prepare for performance and practise.

The main advantages to drummers and percussionists for having strong, healthy and balanced hand and grip support muscles (i.e., Great Hands) is:

1. Maximum speed, strength, control and stamina of the fingers, thumb, hand, wrist and forearm for maximum performance.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among guitarists,

3. Maintain maximum blood flow to avoid cramping and fatigue during practise and performance,

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended drums/percussion exercises using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise, 3) Finger Tip Grip

To all musicians:

The inherent nature of imbalance and instability that threatens the health and performance of musicians in each discipline is to be consciously learned and scrutinized by musicians, music teachers and researchers alike.

The solution is always the same: *Train the muscles of the kinetic chain of grip properly through full, natural ranges of motion.* You'll be prepared for anything.

CHAPTER 15
GREAT HANDS IN THE WORKPLACE

The author would like to start this chapter by praising heavily the role that ergonomics and ergonomists have played in the evolution of workplace safety and injury prevention in our modern world. It cannot be imagined how damaging most workplaces were *in the old days*. But workplace safety, performance and injury prevention evolution is not complete. Nowhere does training the *kinetic chain of grip* go more underserved then in the workplace.

It is the wise and seasoned business owner who invests in a proactive grip muscle training program for their grip-dependent employees. They know it is a service to their employee's well-being and productivity, as well as to their own bottom line. Moreover, staff wellness efforts lend to building a positive tangible culture within the business.

But most grip-related businesses and professions, 1) do not recognize the problem at all, 2) address the problem partially, or 3) choose to look away.

Workplace injuries due to chronic daily repetitive gripping are a cost to both the employer and employee. Workman's compensation costs and personal health and performance costs of the employee inside and outside of work all add up.

Ergonomics alone are often the solution of choice for business owners, a decision to be applauded. Workplace ergonomics are essential, but are not the whole story by a long shot. Workers are not static machines; they are active, reactive, vital, intelligent entities that innately adjust to working on non-neutral tasks in workplace environments.

The author refers to neutral as 'body neutral' or 'standing neutral' where the hands are by the side and the chin is level. How many jobs can you think of that require that position? Once the hands venture away from the body's side, they are no longer truly neutral.

Ergonomics ensures that the position of the body is neutral *in relation to the work station or workers equipment*. It is indeed a workplace necessity (so as to limit the degree of strain to which the body must endure), but ergonomics alone will not lead to healthy strength, balance and circulation of the body's tissues; it simply limits the damage. Exercise is what maintains muscles and tendons, and creates healthy circulation for healthy productive workers.

For example, when a person sits at the computer and does office work, it is absolutely valuable for the computer monitor, keyboard and chair to be adjusted to proper ergonomic height. No doubt. It is also valuable for the computer user to alternate sitting and standing. No question.

But consider the muscles of the *kinetic chain of grip*. Even when the hand, wrist, and forearm are perfectly neutral to the keyboard, they will become imbalanced and overused because of asymmetrical muscle contractions needed to hold the arms forward, pronate the forearms, hold the hands up, and support the finger and thumb muscles that eventually strike the keys. If ergonomics were ignored (the forearms were too high or too low) in this sample situation, the imbalances and overuses would be exponentially worse.

Ergonomics does not trump job mechanics. Instead, it manages the extremes of the challenges of repetitive work. Ergonomics reduces the chronic stress on the joints and tissues of the body by creating sensible workplace environment designs that best match each body design.

The best approach to workplace production and health maximization is to include ergonomics ***plus*** ergonomic exercises (i.e., Ergocises™) to the environment of each worker. In that situation, we eliminate insensible exposure to advanced stress (i.e., ergonomics),

plus we offset the grip action stress that is unavoidable in repetitive jobs (i.e., Ergocises).

The author believes that business owners should view employees in their business the same way that the owner of a pro sports team views their athletes. Provide the environment for your workers to perform at their best and your business cannot help but succeed.

Let's look at some unique workplaces where attaining and maintaining Great Hands is an enormous benefit.

Computers, Tablets & Smart Phones

Much of today's finger, thumb, hand, wrist, carpal tunnel and elbow problems begin and end with the challenges brought on by the digital and computer world (esports and gaming has it's own chapter, see Chapter 16). We are constantly gripping, constantly pressing thumbs and fingers and constantly having to support hands, fingers and thumbs in the air against gravity. All is happening through smaller and smaller ranges of motions as technology *'evolves'*.

The posture of the hands, wrists, carpal tunnels and forearms have never been challenged more throughout human history than now. An additional book would be needed to begin to describe the many challenges to the posture of our human spines. And we have yet to see the totality of the consequences.

Computers, laptops and tablets demand that users work in the 'palm-down' position which creates a double-stress for the finger, thumb and wrist extensor muscles and tendons (review Chapter 3, if needed) as they must contract to 1) support the position and actions of the finger and thumb flexor muscles in striking the keys, and 2) they hold the fingers, thumb and hand 'up' against gravity. This creates static extensor muscle overuse that may eventually show up as stiffness and soreness, DeQuervain's tenosynovitis (i.e., a thumb extensor tendon inflammation), wrist extensor tendonitis, or tennis elbow.

Keep in mind that all of these chronic imbalances and weaknesses are taken to other activities. The computer user may be a

musician or grip-athlete or may do artwork or crafts as a hobby. The author commonly sees multiple grip-related activities as part of the imbalance injury cause from which help is sought.

Smart-phones are in a league of their own. We grip them with our fingers, we text with our thumbs. Does that sound like a natural motion?

The thumbs and lateral wrist (i.e., the thumb-side of the wrist) are now constantly in a 'thumb-down' position and are therefore doing double duty. The thumb extensor muscles and the wrist abductor muscles (i.e., holding the wrist 'up' on the thumb side) must contract to: 1) support the actions and positions of the thumb flexor muscles in texting, and 2) hold the thumb and wrist 'up' against gravity.

The result is a surge in 'texting thumb,' what has also been called 'smartphone thumb,' 'iPhone thumb,' 'Android thumb,' and 'Blackberry thumb,' what is called 'gamer's thumb' (see Chapter 16) in gamers, what has been called 'Mother's thumb' in new moms and what used to be called 'washer woman's thumb' before automatic washing machines. Health Care professionals call this syndrome DeQuervain's tenosynovitis. All names refer to the inflammation of one of the extensor tendons of the thumb and/or their protective sheath.

The author seems to have been the first to 1) propose that the 'thumb-down' (thumb pad facing down) adds mechanical stress and responsibility to the extensor muscles of the thumb, thus further placing that individual at risk for DeQuervain's tenosynovitis, and 2) propose that the 'palm-down' position of the hand places double-duty on the finger and wrist extensor muscles, thus placing an individual further at risk for wrist and forearm extensor tendonitis and tennis elbow (i.e. computer, laptop, tablet).

When we hold cellphones in our hands, we cause the small intrinsic muscles of the hand to contract chronically creating the potential for carpal tunnel stress as well as finger, hand, wrist and elbow imbalance and limited circulation. Proper hand muscle and grip support training is essential to keep the *kinetic chain of grip* healthy

and balanced for those who are regular users of cellphones, tablets, laptops and/or desktop computers.

The benefits of Great Hands for cellphone, tablet, laptop and/or desktop computer users are:

1. Effortless speed, control, stretch and stamina for the fingers, thumb, hand, wrist and elbow for efficient function.

2. Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among cellphone, tablet and computer users,

3. Maximum blood flow to keep tissues healthy and avoid cramping and fatigue,

4. Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended Handmaster Plus exercises for cellphone, tablet, and computer users: 1) HO/HC, 2) Figure 8 Exercise, 3) Finger Tip Grip

Dental & Surgical

The dental profession presents some of the most surprisingly challenging workplace grip muscle patterns that we have studied thus far (using sEMG), dental hygienists and dentists specifically.

If you recall, we suggested that there are 6 factors that we look at in general to determine how physically demanding a grip-related job or activity would be. We'll do this *only for dental hygienists* in this current example only, but feel free to categorize yours or any grip activity the same way. Let's get an idea why the author believes every dental hygienist, dentist and dental assistant should focused on attaining and maintaining Great Hands throughout their career.

They are:

1) **Grip pressure** required – *moderate to high.*

2) **Size, shape & weight** of item gripped – *smaller than hand size, thus challenging. Thus, CTS not uncommon* Not heavy weight.

3) Is the grip item **moving or striking**? *Often vibrating, thus challenging.*

4) **Hand position**? - *often palm-down, so stressful on finger & wrist extensor muscles,* thus exposed to wrist and forearm tendonitis and tennis elbow.

5) **Range of Motion (ROM)** - repetition in small ranges of motion creates imbalance via adaptive shortened muscles and tendons

6) **Length** of grip activity – *long periods of time without a break during cleanings*

7) **Rest time** – *varies, but often little time between patients, little rest between days working; should be prioritized by practices.*

An article on cbc.ca in December of 2019 speaks to the shortage of dental hygienists in Saskatchewan, Canada and addresses challenges within the profession, including the risk of developing RSI's. 'Hygienists are also at high risk for ailments like carpal tunnel syndrome and other repetitive strain disorders.'[52]

Professional performance in the office is highly predicated on physical preparation and awareness of body function and balance. Without proper physical grip training to negate constant grip demands, dental professionals will be greatly challenged by overuse and grip imbalance issues.

Surgeons are not unlike their dental professional comparison. They work commonly in palm-down positions, using smaller-than-hand sized instruments, and work long periods without breaks. A surgeon's career is greatly dependent on their physical ability.

The main advantages to dental professionals and surgeons for having strong, healthy and balanced hand and grip support muscles (i.e., Great Hands) is:

1) Effortless strength, control, and stamina of fingers, thumb, hand, wrist and forearm for maximum treatment performance.

2) Reduced exposure to finger, thumb, hand, wrist, carpal tunnel and elbow injuries common among dental professionals,

3) Maximum blood flow to avoid cramping and fatigue during treatment,

4) Improvement of upper extremity circulation and lymph duct drainage aids all tissue health (tendon, muscle, ligament, fascia, joint cartilage surfaces), as well as general health.

Recommended Handmaster Plus exercises for dental professional & surgeons: 1) HO/HC, 2) Figure 8 Exercise, 3) Finger Tip Grip

Trades

The trades that are plagued by repetitive gripping and/or repetitive wrist motions while gripping (i.e., especially *grip & rotate* and *grip & repetition* dilemmas)

Adherence to Great Hands principles that reflect a complete understanding of the kinetic chain of grip will maximize performance and reduce their risk of repetitive grip injuries.

Below are other leading grip-demanding professions and workplaces that demand an understanding of the kinetic chain of grip and proper training protocols (i.e. ergocises).

Tradespeople and the rest of the grip-related workplaces below will benefit from the following exercises from Chapter 9: 1) HC/HO, 2) Figure 8 Exercise.

Food – Butcher & Chefs

Retail Checkout

Banks

Assembly Line

Truckers & Transport

For more information or consultation about grip in the workplace, email info@doczac.com

CHAPTER 16
GREAT HANDS FOR ESPORTS & GAMERS

Esports have quietly taken over a generation. Esport viewership has skyrocketed. And esport athletes are making career and commercial ground that most lay people will find difficult to fathom.

Since 2016, there has been a significant increase in eSports viewers. Between 2016 and 2017, there was a 19.3% increase year over year. In 2017, there were 192 million casual viewers and 143 million enthusiasts, making the total audience 335 million. In 2018, the year-over-year growth rate had slightly dropped at 13.8% although that's still a sizeable increase. In 2018, there were 215 million occasional viewers and 165 million enthusiasts. So the total audience size grew to 380 million. By 2021, Newzoo predicts that the annual growth rate will be approximately 14%. They also predict that the number of casual viewers will grow to 307 million and that there will be 250 million eSports enthusiasts, making the total audience 557 million.[53]

E-sports facilities are coming up and the most elaborate new facility almost certainly will be the $50 million esports stadium that Comcast unit Spectacor, which also owns the NHL Philadelphia Flyers, said it will build for its Fusion team. Consider also that currently there is a) Allied Esports' HyperX Esports Arena in Las Vegas b) Full Sail University's Fortress Esports Arena near Orlando c) Esports Stadium Arlington in Texas, d) Amazon owned Twitch streaming platform buying a sponsorship with the Las Vegas Raiders, and e) New Allegiant Stadium that includes a branded lounge. (Adam, 2019).[54]

According to Wealthy Gorilla, the top 5 games of 2019 are Minecraft, Fortnite, Grand Theft Auto 5, Tom Clancy's Rainbow Six Seige and Super Smash Bros: Ultimate. (Matt, 2019).

The average esports salary is about $60,000 per year. The highest overall esports salary is currently over $3,620,000 USD, earned by Kuro Takhasomi, a Dota 2 player. Currently, Johan Sundstein from Denmark is the highest esport earner in 2019, with over $6,890,000 USD from 109 Tournaments.[55] 16-year-old Kyle 'Bugha' Giersdorf, from Pennsylvania took home a $3-million dollar grand prize after he was crowned king of Fortnite in 2019. The Fortnite tournament was held in New York's Arthur Ashe tennis stadium.

The International is the biggest esports event in the world. It is a Dota 2 tournament hosted annually in August at a different location around the world. The 10th International is in Sweden. Other locations have included Seattle, Vancouver and Shanghai. The Aegis of Champions trophy (awarded to the winner of The International) has been called the most coveted trophy in esports. The prize pool for The International has rose steadily from $1.6 million USD in 2011 to over $34 million in 2019.

Esports are also gaining shocking ground at high amateur competitive levels. Is it possible that we will see esports and gaming in the Olympics one day? It's not that much of a stretch.

According to a December 2019 article in The Esports Observer in, 'The Southeast Asian Games (SEA Games) has introduced competitive video gaming as a medal discipline for the first time this year, with eight countries submitting teams across six games: two PC, two mobile, one console, and one card game.'[56]

The SEA Games are a biannual multi-sporting event, regulated by the Southeast Asian Games Federation, and supervised by the International Olympic Committee (IOC) and Olympic Council of Asia (OCA).

Esports are not only here to stay, they are dominating the digital and entertainment marketplace. Esports and gaming, whether the

reader is aware or not, is well-established and well-blended into the fabric of our cultures and societies.

Unfortunately, the static and repetitive physical demands placed on esport athletes create both a short-term and chronic ergonomic nightmare. 'Most e-gamers do not do any physical activity, at least which is related to gaming. As a result, most of them complain about injuries such as eye fatigue, neck-pains, wrist pain, hand pain and back pains.' [57](Di Francisco, 2018)

The author has worked with many esport athletes and has studied the mechanics of many of the popular games with regards to performance, stability and repetitive actions demanded of the fingers, thumbs, hands, wrists, carpal tunnels, forearms and elbows. Challenges to the *kinetic chain of grip* are inherent and immense within esports.

Dota 2 is a classic example of a 'palm-down' activity that upon first glance does not seem physically daunting, yet is extremely challenging. The athlete works a keyboard with one hand and a mouse with the other. The keyboard hand is doubly challenged in that the extensor muscles of the fingers, thumb and wrist are contracting constantly in practise and competition to support both: 1) the actions of the fingers and thumbs in making fast repetitive key strokes, and 2) the weight of the fingers, thumbs, and hand against gravity (refer to Chapter 2 How Grip Works to review the challenge of working in a 'palm-down' hand position).

In addition, the mouse hand is palm down and working in a very small range of motion as the fingers and thumbs oppose and adduct to control the mouse. This will not only present challenges to the strength, balance and blood flow of the fingers, thumbs, wrists, forearms and elbows, but also to the structure and circulation of and through the carpal tunnel.

When advancement may mean that a career (or even millions of dollars) is at stake, all competitive, health and fitness advantages must and will soon be sought. Finger and thumbs muscles and the muscles that support the hand and wrist are a central consideration. For most

esport athletes and gamers, there is currently little training, but that will change by necessity. It is not uncommon for esport athletes to have long days and multiple hour practise sessions without a break, though all schedules are different. 'Practice time is still quite fractured, but given the different demands between games and genres, this isn't always a bad thing.' [58](Ashton, 2017).

Esport athletes, as much as any athlete, require Great Hands. They must understand *the kinetic chain of grip* and train their finger, thumbs, hand, wrist, carpal tunnels, forearms and elbows accordingly to prevent injury and ensure maximum performance, as well as continued career competitiveness and longevity.

All esport games have similar physical challenges. As esports continue to rise in popularity and prize money, the author is convinced that esport athletes will react more quickly than most repetitive grippers in adapting a regular healthy regiment of hand strength, balance and blood flow training into their daily routines.

The main performance advantages to esport athletes and gamers of having strong, healthy and balanced hand and grip muscles (i.e., Great Hands) are:

1) Quick, strong, finger and thumb muscles for keyboard, mouse, and console control.

2) Properly trained hand and wrist support muscles that do not become fatigued, static or imbalanced.

3) Reduced exposure to finger, thumb, hand, wrist, carpal tunnel, forearm and elbow injuries (both acute and chronic) common in esports.

Recommended training exercises for esport athletes and gamers using Handmaster Plus: 1) HC/HO, 2) Figure 8 Exercise

For more information or consultation about grip muscle training for esport athletes, email info@doczac.com

Chapter 17
Great Hands As A Metaphor for Life

BONUS CHAPTER

This final chapter has been added for the benefit of those readers who are curious or actively engaged in the topic of *'the meaning of life,' 'life path,' 'life purpose,'* that sort of thing. It is a bonus chapter, so if it you are not curious, no harm done - though you may still be intrigued by the ideas presented. For those of you who are interested or curious or will simply read to the end, the hands are extremely illustrative and thought provoking when seen as a metaphor for life.

I came to recognize this concept many years ago. The actions, mechanics and principles of the hand muscles seem to act as a mirror when contemplating the constant state of our own lives, and how we as individuals relate as a whole to others, our family, our community, our society, our nation and, indeed, our world.

When the hands close, it can be seen as being representative of a 'taking in' *for oneself*, certainly a necessary demand of life in my opinion. I consider this 'taking in' to be *acquisition* - anything from basic needs such as food, water, clothing, and shelter, to more evolved needs such as life experience, education, skilled learning, and pursuit of natural gifts, and development of skilled service.

Any action whereby the energy of attention comes 'into' an individual can be depicted, via metaphor, as the hand closing.

Let's assume that the innate and intended healthy use of acquisition is to provide us each as individuals with the means necessary not only to survive, but also to serve others and *thrive.* Thus, the *taking in* is essential.

The author has come to consider the act of opening and spreading the hand to be representative of giving, helping, aiding, serving or sharing with another or with many others. Consequentially (and more subtly), opening the hands can be seen as the opening of oneself or the sharing or spreading of oneself.

Any action whereby the energy of attention is given 'away' by an individual can be depicted, via metaphor, as the hand opening.

The first (i.e., the closing of the hands) is service to oneself; the second (the opening and spreading of the hands) is a natural progression of service beyond oneself.

Balance lessons are of course everywhere in life (if we are aware) but can be made clearly evident and are easily demonstrable by using this analogy displayed by the hands.

It holds true that if an individual becomes morbidly stuck on acquisition, and merely *takes and takes and takes* in their life, they will run into a deep imbalance that will show outcomes of discomfort in many places, not unlike repetitive gripping by the hand muscles. These outcomes of discomfort may include failure in relationships, discontentment, stress, or even *disease.*

As we have learned from this book when we *only close* the hand against resistance and thus favour only the closing muscles, we create an imbalance that is seen directly at the fingers, thumbs, hands, wrists, carpal tunnels, forearms, and elbows. Grip imbalance is also reflected generally as limited or poor blood flow to and from the joints and joint-related tissues, and quite possibly as reduced systemic drainage of toxins and by-products by the lymphatic vessels, a key factor in detoxification of the brain and body.

One core cause (repetitive grip imbalance or morbid acquisition imbalance)… many outcomes of discomfort.

Less commonly, one may *give and give and give*, and often appear wise, kind, and altruistic in their effort, but this type of imbalance may mean that the individual has not learned or gained the experience necessary to give in an adequate matter, or in a wise, well-

educated or well-experienced manner. It also might mean that they have been trained or gained experience that is useful, but may give to the extent that they cannot take care of the healthy needs of themselves and/or their loved ones.

Both of these examples can lead to an unhealthy imbalance, but, of course, the major imbalance we see in society is the same imbalance we have seen historically in hand exercise and repetitive gripping. *We close, we close we close… we take, we take, we take… without opening*, thus without opening to give of ourselves or give of our gifts or our wise experiences to others for the benefit of the greater whole.

The hands are a wonderful example that balance is both necessary and achievable.

I believe strongly in this wholeness of life concept. I also recognize the oft-difficult reality of gaining and maintaining this same balance. Working with Handmaster Plus and our many partners throughout the world has been a constant reminder to practise in life what I practise in hand training and injury recovery.

And remember, as body circulation works in an endless circle, so too does our life. We are given a new opportunity every moment to 'get this balance right,' just as we can begin to train our hands properly at any time. It's never too late.

When one develops a hand muscle imbalance and then eventually its resultant injury condition, do not ignore the problem and hope it goes away. Do not sedate the symptom at hand (pardon the pun) and leave the underlying cause of the symptom alive and well to continue to affect the same and other areas. Do not continue the same habits and make the problems worse.

We've all heard the Albert Einstein saying, 'Insanity is doing the same thing over and over and expecting different results.' It's so true.

Symptoms are not bad. Symptoms are feedback. Learn the lesson of the imbalance that the symptom brings you. Learn and get it right.

Regain your healthy balance whether in your hand muscles or in your life.

In golf, the author was taught, *'When you get into trouble, don't get into more.'*

If I hit a drive into the trees, I try my best to learn and make a mental note of what might have went wrong, and then find the most sensible way back to safety. I don't blindly disregard a poor outcome, cry and wine, and risk worse trouble.

We will constantly run into imbalance and the resultant symptoms in our lives. Let's learn from them, grow from them, resolve them and move on. It's the necessary process of healthy evolution.

Imbalance is indeed an important concept to ponder in our world today because, though there is indeed rampant hand muscle imbalance, there is a greater momentum of imbalance caused by individual greed and ignorance from our world's leaders.

Your hands can be a constant reminder of balance in life. At the very least the hands as a metaphor for life gets people thinking. Feel free to share this concept with others. All imbalances can be solved by bringing the cause of the imbalance into light, and by then addressing that cause thoughtfully.

When each of us brings these principles into our own life and uses the hands as a simple example, we can resolve any problem and be confident when say:

Great Hands, Great Life!

THE END

ADDENDUM I
ACUTE INJURY PROTOCOL

(Finger, Thumb, Hand, Wrist, Carpal Tunnel, Forearm or Elbow)

STABILIZATION – TREATMENT – RECOVERY

1. The first step with any injury is STABILIZATION.

If the injury is severe or uncertain, call an ambulance or travel safely to a hospital.

Non-emergency STABILIZATION of an Injury, overuse or imbalance condition can be represented by the acronym **PRICE**:

Protect - Utilize a brace to support the injured, weakened or unstable area. Contact a health care professional immediately.

Rest - Do not challenge the injury. Do not risk re-injury. Re-injuries can be more serious than the original condition.

Ice - Ice the area for 15 minutes on & 15 minutes off 3x per day for 3 days (or as instructed by a qualified health care professional). When icing, place a layer of cloth between the ice and the skin to tolerance.

Compress - Including tensor bandage and/or brace.

Elevate - Keep area above the level of the heart to reduce blood flow and minimize acute inflammatory response.

2. TREATMENT – Utilize a healthcare professional who is proficient in upper extremity care.

3. RECOVERY – After treatment, can you move your hand in a pain-free manner through full opening and full closing? If so, begin recovery exercises using Handmaster Plus soft strength based on consultation from your health care professional.

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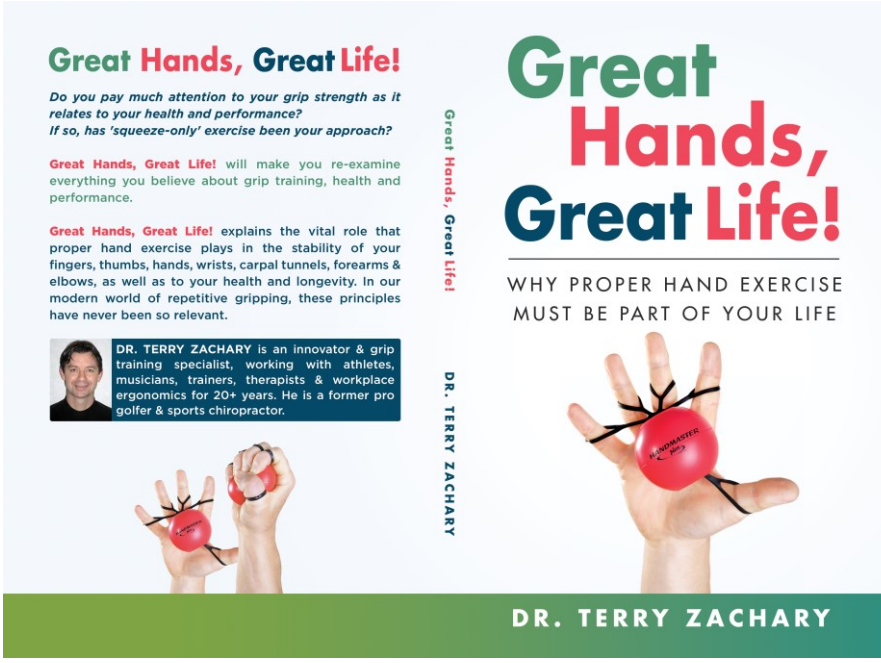
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