TRADITIONAL VS. SPORT KARATE

Let me start this piece by clearly stating my view on this subject: In my personal opinion there should never be a debate about which is better, *traditional training* or *sport karate training*. They both compliment each other, and each should be respected for what it brings to the table in terms of improving a Martial Artist's abilities and performance. I apologize for some generalizations. I understand that not all traditionalists look down upon sport karate.

DIFFERENT CONDITIONING NEEDS?

Traditionalists claim that karate's only goal as originally conceived was to "incapacitate an adversary with one blow". This is certainly true of Shotokan, although other styles like Wado Ryu tend to favor combinations to the "one punch" technique. Then they claim that sport karate's goals are to score points by tagging an opponent. Very true. I would add to that that an equal part of that goal is to avoid being tagged or hit.

Now, I could go into an in-depth analysis of the body's needs to perform both of these sets of goals optimally but it would be pointless as it is all covered in the *Training Center* of this site. But here's a news flash.... For the most part, they are one and *the same*.

Sport Karate athletes do a lot of ancillary athletic training to increase their speed, strength, explosive power, focus, coordination, timing and endurance... Now which of those are *not* useful in a street fight? Which does a traditionalist feel they *don't* need or can't benefit from?

Perhaps it is the sport karate athlete who does not need some of the traditionalists' training. There are a lot of ancient practices in traditional karate which I personally disagree with. Keep in mind that traditional training was conceived without the benefit of modern sports science and medicine. The pioneers were basically using their common sense to derive the best training conceivable. On the whole they did a terrific job. However, we must learn from medicine and science and improve on the old.

This is the *only* difference that I see in conditioning needs: Traditionalists have historically believed that they needed to "toughen" up their knuckles, forearms, shins etc, to be able to resist pain and injury when hitting or being hit in a fight. *I* was brought up in this way. Yes, in the short term calcifications do strengthen your bones and constant impacts desensitize nerve endings so that blows are less painful. There are however many long-term detrimental effects to be considered such as *arthritis* and one must be aware of these and weigh it all out responsibly. But that's a different subject. The bottom line is that the conditioning needed by both groups is essentially the same if they want to perform at their peak!

ARE SPORT KARATE ATHLETES NOT "MARTIAL ARTIST"?

As someone who grew up studying traditionally and also trained and competed as a "sport" karate athlete, this question makes my blood boil! This is the kind of comment I have historically heard voiced by those who either never did well in competition (usually kumite but on occasion kata as well) or who never had the courage to compete at all.

Why is it that a Martial Artist who has taken his or her training a step further and sought physical perfection to enhance the performance of his or her techniques, is any less of a Martial Artist than the guy with a huge beer gut who never stepped foot in a ring? Most, if not all, sport karate athletes also train using traditional methods. It is by doing so that they have mastered their techniques!

SPORT KARATE ATHLETES ARE NOT CAPABLE OF STREET FIGHTING?

This is another subject which just plain annoys me. Let me again point out that "Sport" karate athletes also have a traditional background and also usually train in traditional dojos. Yes, a large portion of their training will focus on tournament style fighting. However, most will also often "let loose" with their sparring partners or *Senseis* in "freestyle" non-stop kumite (fighting) which can include grappling, knees, elbows, head butts etc. (All controlled of course.)

This kind of sparring is important not only from a physical and stamina perspective but to increase the brain's "library" of actions and reactions so that the next time you will react to similar stimuli even quicker.

In addition, as any real fighter will tell you, its just plain fun! An athlete training for world class tournaments needs to spend a lot of their time on tournament style sparring. This is a great break from it. Again, I don't know any fighter who doesn't do a fair amount of freestyle sparring.

So, so much for the idea that the "athlete" is not street prepared. Some will argue that the "point" style training will be detrimental on the street. Hmm... Watch a point fighter closely. Occasionally you will see one who has been intentionally fouled and the referee does not see. Watch what happens next... The next technique tends to be an extremely powerful, pain-inflicting one such as a *gyaku* to the solar plexus that seems to go through the opponent! As the opponent lies in a collapsed ball on the ground, tell me again how this athlete will inadvertently be pulling punches on the street. I don't think so.

The fact is that the training a sport karate athlete must go through enhances their *control of distance* (both body and impact). Control means just that... they can *control* it better. If they choose to deliver more contact they can do so because they have that control. It's simply a question of what they desire.

FOCUS -Athletes train focus with focus mitts etc... They are less likely to miss their target.

EXPLOSIVE ENERGY -Athletes train to be the first off the mark. Their technique has to be delivered in a fraction of a second when either an opening appears or is created. Again, this is useful on the street.

ENDURANCE -What if you don't nail your attackers with the first technique... what if you are fighting multiple attackers? Surely the fitter fighter will have an advantage over the beer gut guy.

DEFENSE -Sport Karate Athletes are trained to avoid getting "tagged", let alone hit! Again, a useful practice on the street I'm guessing... (well, not really guessing - I know!)

Most importantly, "sport" karate athletes constantly face opponents whom they either don't know, or sometimes may not like. These opponents want to win as much as they do, if not more. There is no training in the dojo that will compare to the experience of having a total stranger in front of you whom you know doesn't care about you wanting to drive his foot through your rib cage!

Despite the confines of tournament rules, "accidents" do happen and sometimes people end up in wheelchairs for the rest of their lives. This is far less likely and common in the dojo. So yes, you learn to *concur fear and balance self-assuredness with caution*. You get to practice psychological warfare on strangers. These in themselves are incredible lessons to master. Occasionally we become too self-assured or cocky and end up on the floor. Too much caution, and we will freeze up and also, end up on the floor ...

There is one last attribute which a karate athlete brings to a street fight which a pure traditionalist may not. The ability to switch "on" and switch "off" almost instantly. Although *switching off* sometimes takes a bit longer due to the adrenaline rush. - These athletes can get in the zone quicker and be prepared sooner to do battle than someone who has not trained in this fashion.

Lastly, I can tell you that I survived a stabbing attack in Quezon City from 4 attackers and made only one mistake. When confronted with the knife I waited and tried to talk sense into the attackers. When the knife cut through my leather jacket and almost penetrated my chest, I swung into action. The fight lasted about 10 seconds... One attacker ran, 3 were downed.

I was essentially a sport karate athlete at the time... And no, I don't think I'm special. Many of my friends have overcome street adversity with ease.

IS IT POSSIBLE TO BE TRADITIONALIST AND NOT LOOK DOWN ON SPORT KARATE?

I think so. I am a strong believer in the values of traditional training, but I also believe it can be enhanced. Once again, as much as my ego wishes me to rush to the conclusion that I am unique and innovative in my views, I know there are a lot of you out there that feel the same. I know, because I've met you.

CONCLUSION

In conclusion let me emphasize that without traditional training there is *no* proper training of technique which is essential for *all* fighters regardless of their goals. However, before criticizing a style, whether it is a different Martial Art, or traditional vs. sport karate, take some time to fully study all the factors objectively. *Ying* can not exist without *Yang*. Sport karate can not exist without traditional technique training. Traditional training can exist without, but does better with sport karate training and conditioning methods. Don't take my, or anyone else's, word for it. You have a brain, use it to process all the information it accumulates and make an informed and educated decision about things.

Ignorance is not an excuse...

ZEN AND BUDO STRATEGIES IN TOURNAMENT FIGHTING

THE ZEN STRATEGY

There is a good reason the samurai adopted Zen philosophy and its strategic insights - it optimized fighting strategy and taught them to deal with fear and death to obtain victory. It's benefits were proven over hundreds of years in situations where the penalty for failure was not loss of a "point", but death. Today Zen is rarely taught in fighting, and the focus of martial arts classes are usually all physical despite the fact that the mental component is the most important attribute in any fight --- tournament or real life.

Asian strategy (e.g. the classic "Art of War" by Sun Tzu) and Zen are not religions but provide systems for understanding yourself, optimizing technique and performing at your best. It is unfortunate in modern sport karate fighting (which is also a mind game) that athletes are not taught the Zen concepts which are the basis of the art they are performing.

Some sports karate teams do go as far as to have sports psychologists, and while that is beneficial, it is shame the athletes are not exposed to the Zen lessons of the samurai which are profound in achieving victory because the goal was not a gold medal, but a life or death match (where, like in the sports world, a simple "tag" with a katana (sword) would mean death).

Some of the principles taught by sport's psychologists mirror that of Zen in the martial arts and other things taken from Zen are more specifically directed towards combat. The modern term of putting oneself in "the zone" is directly analogous to the Zen mind state of *mushin* - one Zen principle which can be related to kumite and it is discussed in more detail below.

HOW DOES THE BELOW PHRASE AND IMAGE RELATE TO FIGHTING?

"Like a full circle, the mind must be empty, yet complete."

The Japanese term often used in karate which is loosely translated as "empty mind" is *mushin*. This term does not strictly imply "no thought", but rather no attachment to any one thought, emotion or strategy. To obtain this state of mind, *mushin,* you must let go of your fears, doubts, ego, and any preconceived thoughts of action (strategy), or the mind will not react openly.

When we apply *mushin* to certain techniques and kumite strategies in seminars many karate athletes start to say, "...well you have to be analyzing your opponent and formulating a strategy so it doesn't apply...". They often miss the point at a first glance -

it revolves around the assumption that you have trained the mind to know all these strategies innately and that at any moment in kumite the right one for the situation is released without thought. This creates the required speed (i.e. no delay) and enables dynamic adaptive change to your engagement strategy after the opponent begins to react (which enables another innately trained technique/combination to emerge as soon as it is needed).

There are drills, combinations and training methods to enhance the mind state of *mushin* (other than one simple example below this article does not attempt to describe complex combinations and partner work via text). The application of the mind is usually reinforced whenever one speaks with, or does seminars under, any of the great karate tournament legends - they almost always comment on the importance of the mind as a key to victory.

A simpler conceptual analogy for *mushin* which removes the complexity of strategy is the following: imagine fighting someone who truly has the ability to strike you with any one of their 4 limbs at any time (i.e. their physical balance and ability allows it, and their mind does not favor a punch, or kick, or a particular limb). Many of you may have fought such a person, and these people are always tricky fighters due to the fact that any limb can come out at any time i.e. no attachment or predisposition to any one thing (*mushin*). As one works on kumite this is one physical-mental approach which can be drilled.

There is a famous Zen saying "*mizu no kokoro*" which also helps clarify *mushin*.. Mizu no kokoro on the surface translates to "a mind like water." Everyone understands how the water of a pond can be calm and clear. In this state, it will reflect all around it truthfully & accurately, much like a mirror.

In Karate and in life we strive to have a calm mind that reflects everything around us accurately. Therefore, the mind must be clear like the glass surface of a still pond, reflecting everything accurately and without distortion. If the mind gets attached to any thoughts, this is analogous to throwing a stone into the tranquil pond. The ripples that the stone creates (or thought in the mind) will interfere with the smooth surface of the pond making the reflection (perception) distorted. If your mind is cluttered with thoughts, how can it possibly react quickly in stressful situations? Only when the mind is clear and calm will you act instantly without hesitation or fear.

The term "void" (kara in Japanese) has very real implications for strategy, Zen mind set and accessing weak points in an opponents technique and body. Since 1929 this term has in fact been the first of the three Kanji (Japanese characters) that represents the word "Karate-Do". The Keio University Karate club substituted this character to replace the original first character for Karate-Do (prior to this the first character translated the term karate as "Chinese hand"). The act of using "void" as the first character in Karate-Do was later consolidated in 1935 by Funakoshi Sensei publishing the book "Karate-Do Kyohan". The link between "voids", or "emptiness", has obvious similarities to *mushin,* however, its mental implications for strategy go far further than that. The mind is just one component of a "void" approach used in fighting. Other cumulative uses of the "void" concept include:

- Technique combinations which open an opponent enabling the scoring of a "point" (pre-determined opponent response strategy which occurs following a particular combination).

    - Furthering the first two points by striking a cavity, or anatomical void, to most damage/upset the opponent.

The emphasis here is to use all three "void" approaches in a cumulative fashion. Therefore, fighters can chose to train certain combinations that provide a three pronged approach of creating mental voids, physical opening voids, which are then followed by impact on an anatomical void. The goal here is to not only score points but also mentally optimize one's position of confidence and strength relative to the opponents physical and mental state. Again, I do not believe a text forum to be the appropriate place to describe physical technique combinations based around a multi-tired use of "voids" in fighting (these are covered in seminars and dojo training).

Although this article mentions just two karate related Zen concepts a number of others exist which are highly relevant to kumite performance. All such concepts can be worked on as part of one's training to optimize tournament fighting. Other Zen-based lessons can include:

- Centering in a bout (physically and mentally) - upsetting your opponents "centered confident state"

- Striking voids (mental and physical combinations)

- Progressing through the stages of Zen as one's fighting improves

- Reading your opponent

- Dealing with fear and anxiety to perform at your best

- Fudoshin

- Use of *Aiki* and *Kiai* to upset your opponents mind game, and at the same time create physical openings for standard technique scoring

DO GENES DETERMINE CHAMPIONS

ARE YOUR PARENTS RESPONSIBLE FOR YOUR WINS AND LOSSES?

We all know of champion athletes whose parents and perhaps grandparents were also champions.

Moreover, racehorse owners spend millions of dollars on stud fees to breed winners. This seems to tell us that champions are born and that if you don't have the "champion gene," you can never be truly successful, no matter how hard you train. In other words, you must be wasting your time practicing your favorite sport if your parents were not champions themselves. But if champions can be bred, why don't all racehorses bred for performance become champions? The reason is that there are factors other than heredity that play important roles in performance, too.

GENES ARE MORE OR LESS IMPORTANT

There is no getting around it; genes determine our potential for developing many of the structural and functional characteristics important in determining sport performance. For instance, to be a successful center in the National Basketball Association, you must inherit the gene for tall stature. For other characteristics, though, diet, training, and other environmental factors play a huge role in how your genetic potential is expressed. For example, you may have the genetic potential for a low body weight, but eating too much and exercising too little can overcome that genetic message and cause you to become obese. Thus, some characteristics like height are strongly influenced by genes, whereas others like abdominal girth are less affected by the genes and are more likely to be influenced by the environment. Table 1 illustrates how strongly the genes typically affect some of the structural, functional, and performance characteristics of the body.

Those characteristics in the table for which the genes have only a low to moderate effect (e.g., balance, reaction time, accuracy of movements) are likely to be more powerfully influenced by training, diet, and other environmental factors than are characteristics like strength and flexibility, for which the genes have a large effect.

TABLE 1. EFFECTS OF GENES ON STRUCTURE, FUNCTION AND PERFORMANCE

CHARACTERISTICS	EFFECTS OF GENES
Height, Length of Arms	Large
Heart Size, Muscle Fiber Composition , Lung Size & Volume	Large
Blood Pressure, Air Flow in Lungs, Movement Speed	Moderate
Muscular Strength, Flexibility of Joints	Large
Reaction Time, Accuracy to Movements, Waist Girth	Small to Moderate

Muscular Endurance (e.g., push-ups, pull-ups)	Moderate to Large
Aerobic Endurance (e.g., distance running, cycling)	Moderate to Large

The genes also determine the speed and extent to which your body's performance characteristics respond to training, diet, and other environmental factors. For a given characteristic, such as aerobic endurance or muscular strength, some people are strong responders to training and others are moderate or weak responders to the same training. What this means, for instance, is that even though your genetic potential for distance running may be less impressive than that of a competitor, you may be able to develop that potential more quickly and completely by training hard so that you can always beat your opponent. There is insufficient published research on how strongly genes affect an individual's response to training to be certain, but Table 2 lists some of the early conclusions from this research.

TABLE 2. EFFECTS OF THE GENES ON RESPONSES TO EXERCISE TRAINING

RESPONSE TO TRAINING	EFFECT OF GENES ON RESPONSE
Strength	Small
10-Second Maximal Power Output? Bicycle Ergometer	Small
90-Second Maximal Power Output? Bicycle Ergometer	Large
Aerobic Endurance	Moderate to Large

It is likely that the small genetic effect on the response of strength to resistance training will be greater when studies are completed with larger numbers of subjects. The training effect on power output in 10 seconds was only weakly affected by the genes, possibly because technique and reaction time?both little affected by genes?are more important than raw strength, more strongly affected by the genes.

Tactics and techniques?such as drafting and using an aerodynamic body posture in cycling?are critical to success in many sports but are not affected by the genes. Champions at the elite level must be experts at tactics and technique in addition to possessing the necessary genetically determined attributes for success in their sports. Still, less genetically gifted athletes who are talented in tactics and technique may become champions at non-elite levels of competition.

SUMMARY

Whether you can be a champion is determined by 1) many of your structural, functional, and performance characteristics before training, 2) proper training, rest, and nutrition, 3) the speed and extent to which these characteristics adapt to training, and 4) your mastery of tactics and techniques in your sport. It is probable that elite athletes are those who begin with high levels of the characteristics needed for success in their particular sports, have large responses to training in those characteristics, and have mastered the necessary tactics and techniques. However, at a less than elite level of

competition, you can compensate for a "non-gifted" genetic potential with optimal training and nutrition and by mastering the tactics and skills required for excellence in your sport.
For a given individual, it is not possible to predict whether or not or the extent to which a characteristic such as vertical jumping ability will respond to training. Moreover, many athletes reach a point where they have to train more often and harder to obtain fewer and fewer performance benefits. When athletes reach this point, it is possible that they are approaching their genetic limits

Although your genetic background can influence how successful you might become in a particular activity or sport, this background is probably too complex to be fully known or understood. The possibility of a magical altering of the genes by genetic engineering is very unlikely because many genes are involved, there are interactions among different genes, and there are interactions between genes and the environment.

CONTROLLING EMOTIONS IN KARATE SPARRING

Karate sparring—*kumite*—challenges as much the emotions as the mind and body. The emotion of fear—of injury, for instance—is the foremost internal challenge in *kumite*, followed by anger and frustration. In this article I detail from my experience how anger and frustration have caused opponents to commit technical errors and, ultimately, lose matches, and I then explain how breathing techniques, correct posture, and persistent *kumite* training can control anger and frustration and lead to more successful sparring. Fear control requires separate treatment.

Kumite involves a primal activity—fighting—which naturally provokes one's primal urges. However, although anger, for instance, may give a fighter a feeling of increased power, brute force is no match for superior technique. Man is the dominant species because of intellectual, not physical, superiority. Karate technique is a product of this high intelligence and thus is diminished by countervailing emotion. Successful karate demands emotional self-control.

Likewise, frustration during sparring is necessarily counter-productive. Although becoming frustrated may result in higher motivation and thus greater effort in *kumite*, to 'try harder' in Karate is frequently to fail. A karate *koan*, or 'wise paradox,' is that trying less often results in improving more. This is admittedly a higher and inherently difficult concept, but the simple truth at its heart is that proper execution of karate technique requires precision, balance and timing: attributes not achievable in states of anger or frustration.

Because mind and body are a perfect symbiosis—any cause has equal effect on both—aggressive thoughts instantly produce a physical response. Consider the fight-or-flight instinct and its varying levels of intensity proportional to the strength of the associated emotions dominant in the mind. Highly-trained and experienced fighters can use a *managed* level of the instinct for fight-or-flight to heighten their fighting sense. For the less-experienced, however, unregulated emotion results in merely instinctive reflex, and then certain defeat.

That elevated levels of stress and anxiety impair judgment and inhibit the higher learned responses is a truism among not only martial artists but also sports psychologists, police trainers and all types of professional athlete. Situations of extreme stress produce correspondingly extreme detriments to martial performance. A physical confrontation in real life is perhaps the ultimate stress, and accordingly even highly trained martial artists may revert to innate survival responses—tunnel vision, large lunging motions and wild swings—which effectively countermand their training at the critical moment.

Accordingly, it is crucial that fighters, in street or dojo alike, have trained themselves specifically in advanced techniques of emotional control. The lower the state of emotion and instinctive response the better. There is no time for self-counsel during a

high intensity sparring match or fight: no opportunity to analyze feelings of fear, frustration, anger or any other emotion. Therefore, ahead of time one must spend time in what can be called the Three P's: Pneumatics, Posture and Practice.

Pneumatics refers to the study of breathing. From the beginning of a *kumite* match, breathe naturally, which for most people means through the nose. When striking (and strike hard and often) purse the lips and breathe out forcefully. Air rushing past the teeth mixed with saliva creates a hiss: a sound historically common in boxing clubs and martial art schools. It will be necessary to breathe increasingly through the mouth thirty to forty-five seconds into the bout, until the body's ever-higher demands on the respiratory system for oxygen makes the need incessant. This is good. Listen, in this case, to the body.

Breathe naturally as the body requires, but expire forcefully through pursed lips when striking. This simple and effective approach to breathing will keep the blood oxygenated, and allow the muscles to respond properly and the brain to perform its learned response functions. No matter what his levels of physical training, mental rehearsal or psychological conditioning, a fighter without sufficient blood oxygen will be absolutely unable to perform. He will be reduced to fighting with mere instinct, perhaps managing some poorly-performed and rudimentary learned technique, or will simply quit.

It should be noted that there can possibly be exceptions in cases of matches lasting less than thirty to forty-five seconds, where oxygen already in the bloodstream may possibly suffice. In the same way, it is not unusual to be able to run one hundred meters at full sprint while holding the breath. Notwithstanding, the common case is for matches to exceed thirty to forty-five seconds, and so correct breathing is essential.

Posture comes next. Combine the correct breathing with shoulders held down and the body as relaxed as possible. An effective technique here is to avoid grinding or clenching the teeth by partially relaxing the muscles of the jaw. Allow the arms to simply float in front of the body, and keep the elbows down to protect the mid-section. Seasoned Karate fighters take these posture rules seriously, and train themselves to act on them unconsciously, thereby improving their calmness and self-control during *kumite* irrespective of events. To be an expert at emotional control is to minimize error and to recognize and exploit the unconstrained emotions of the opponent.

It is argued that anger in a match actually provides a fighting edge: even an additional burst of energy that outweighs the benefit of posture. While the specific point is mootable, the higher truth remains that anger's putative advantage is more than cancelled out by the manifold harm caused by emotional outburst, most especially when fighting an experienced opponent. A fighter needs exceptional posture and the emotional control that it brings. Energy gained from anger should be quite unnecessary. The expert concentrates on the proven technical issues at hand. Relaxation, then, is essential in accomplished *kumite*, brought about by proper technique: breathe properly, partially relax the jaw, keep shoulders down, and allow the arms to float smoothly. Loss of control and uncontained anger is merely sad testament to lack of experience, and an invitation to the experienced fighter to devastatingly exploit the neophyte.

Relaxed posture, it must be said, is notoriously difficult to achieve. When training for fighting relaxation, there is a natural tendency toward carelessness and even sloppiness. Take the time to train for that perfect but elusive balance between relaxation and attentiveness, and the reward will be the ability to manage the change and surprise which is the nature of *kumite*.

Finally, practice. Success at sparring requires practice, much practice, and at varying levels and pressures—grading evaluations, or *Shinzen Jiai* performance to an audience for instance. Police regularly attend the firing range. Aeroplane pilots spend hours on emergency landing practice at flight simulators. The military are perpetually at drill and on maneuvers. Martial artists, then, should be no less diligent in their approach to sparring: constantly practicing, constantly improving. Cliché or folk wisdom, it is inescapably true: nothing substitutes for practice, practice, practice.

And a last word for the next time when emotions of anger or frustration arise when sparring—as they indeed shall. Let no emotion be allowed in the eyes for an opponent to see and exploit. Whatever the opponent sees must be there at the fighters' own will ... and put there to make the *opponent* angry.

THE CONTINUAL IMPROVEMENT IN KARATE

"Karate-Do Is A Lifetime Study"

Kaizen is a Japanese word that translates to continuous or continual improvement. Kaizen is not just a word, but also a philosophy that is used around the world in a variety of contexts. We will discuss the history of Kaizen and apply it towards life in general and the art of Karate specifically. We will explore the Japanese word Kaizen, although the philosophy is not distinctly Japanese – similar ideas have been explored in many cultures and philosophies.

The word *Kaizen* gained major influence in Japan in the 50's as a method for improving manufacturing. American statisticians came to Japan after World War II to help improve process control and quality control in the manufacturing industries. The result was that every employee was empowered to make recommendations to the process line that would reduce wasted time and activities that were harmful to the finished product. One shining example of a company from Japan that undertook the Kaizen philosophy is Toyota. This company is known for high quality products and a very efficient and tightly controlled manufacturing line.

The Japanese word Kaizen translates literally as "*kai*" – meaning change, and "*zen*" meaning good. The philosophy more generally states that imperfections can be corrected by continually recognizing the source of errors and taking steps to make improvements. These four phases of cycle are:

Plan – Determine where there is an opportunity for improvement
Do – Try the improvement
Check – Decide if the improvement hinders or helps the problem
Act – Adopt or abandon the change (repeat).

The most powerful concept of this cycle is that it is continuous. The following step after taking action to correct and imperfection is to plan again. This philosophy recognizes that even after making an improvement, time must be spent to re-evaluate the current status and continually make more improvements as required. This may work fine for process control in a manufacturing environment, but how does it affect our lives?

The goal of Kaizen is continual improvement (as opposed to Kaiaku – which translates to "change for the worse"). The guiding principle behind Kaizen is that large changes can be made through lots of small, incremental steps toward the goal. It also implies that once you have made many steps toward improvement, there are likely more steps that you can take to continue making improvements.

If we go back to the manufacturing example, any one person can make a recommendation for change on the manufacturing line. The steps at the beginning of the manufacturing process are the foundations of the larger product being finished at

the end of the processes. One small change at the beginning of the process may have a huge impact on the end result.

This philosophy can be applied to our lives very simply. There are activities that we all go through. We all have families, and careers; goal and ambitions; sports and hobbies. All of these activities help us define who we are. Any improvement that we can make in any of these areas will make small, but cumulative effects in our confidence, attitudes, and overall quality of life. Just like the manufacturing process, small improvements in fundamental areas of our life can make profound changes to who we are.

As a serious art, Karate has a depth that allows it to be explored over the course of a lifetime. There is no one step that will take a student from beginner to mastery – it takes time and practice. The principle of Kaizen can help any student at any level make improvements. At any level, a student of Karate can recognize one area for improvement, whether it is kihon, waza, kata, or somewhere else. Sensei David Walker has said, "If I improve one kata by 1%, all of my kata have improved by 1%". This truly is the Kaizen philosophy at work. Small, incremental changes anywhere, will have an effect in other areas of a Karate student's development.

In closing I would like to say that all students of Karate already practice the fundamental principles of Kaizen: incremental and constant improvement through continual training. This philosophy doesn't just come from Japan and it isn't just for Karate – it is a philosophy that anyone can adopt into their lives. We are all human and have our faults and failings. With an idea of the person you want to be, you can adopt the Kaizen mentality and slowly make continuous improvements to meet any goals in your life.

PLYOMETRICS

Modern sports physiology has merged with sports karate to help that domain understand how to move faster, with more agility and powerfully. However, the sports community has to be careful about stating these are modern findings. For example, an often mentioned point these day by the sports karate community is the sports physiology research that reveals that stretching/loading a muscle before expansion leads to a faster technique (in karate achieved by moving back and forth in stance before throwing a technique, or preceding one technique with a movement that stretches/loads the muscles to be used in a following technique). Such examples are real and are one great uses of sports physiology data that sports karate teams adopt and train for.

However, the traditional karate arts have been talking about contraction-expansion in technique delivery for 100s of years. This is one very good example of the old facilitating the new and highlights why one should educate themselves in its time proven discoveries which are the basis of the art being practiced

The physiology behind the above concept (now days called Plyometrics) is well described in textbook "Sports Speed" (Dintiman & Ward, 2003). It provides a good discussion on how the rapid stretching (loading) of muscles activates the stretch reflex, which sends a powerful stimulus to the muscles that causes them to contract faster and with more power. The faster a muscle is stretched with a rapid eccentric loading, the more powerful the following concentric contraction. T

he above tactic (compression followed by expansion in karate technique) is called "plyometrics" in the modern sports physiology world. Training to enhance this phenomenon can be achieved by performing such as actions as jumping, hopping for the legs and throwing for the arms.

PEAK PERFORMANCE AGE FOR KARATE ATHLETE

At what age is a Karate Athlete at his or her peak to perform? If one studies the statistics one would conclude that somewhere in between the early 20's and early 30's would be in an accurate *ball park* (American expression meaning "the right area"). Keep in mind that there are always exceptions to just about every rule, so this information should be used as a guideline of the historical norm. It should in no way discourage younger athletes, or indeed older ones, from competing and expecting good results.

Once again, I apologize to Kata competitors for focusing on Kumite. However, you should assume that similar guidelines prevail with the exception of possibly being able to continue longer due to less injuries and the less violent nature of your discipline. Again, sorry... I don't mean to seemingly neglect you folks... I love you really.... Its just that I know more about kumite.

Due to easy access, I will use the data from the three great champions listed below. I will add others to the tables as their info rolls in the next month or so.

WORLD CHAMPION	AGE WON 1ST WORLD TITLE	AGE WON LAST WORLD TITLE
Wayne Otto	22	31
Christopher Pinna	25	32
Elisa Au	22	24 – (Still Competing)

Why so late? When other sports have athletes peaking as early as 12 or 13? Glad you asked... Lets break it all down...

WHAT MAKES MOST CHAMPIONS WIN FROM THEIR EARLY TWENTIES TO EARLY THIRTIES?

1. Most people start karate as adolescents and are therefore ready to perform at World levels after *at least* 7 years of intense training and competing experience. The more they compete and train, the more tricks they accumulate, the less surprises they come across in the ring, and the smarter they become about training and fighting.

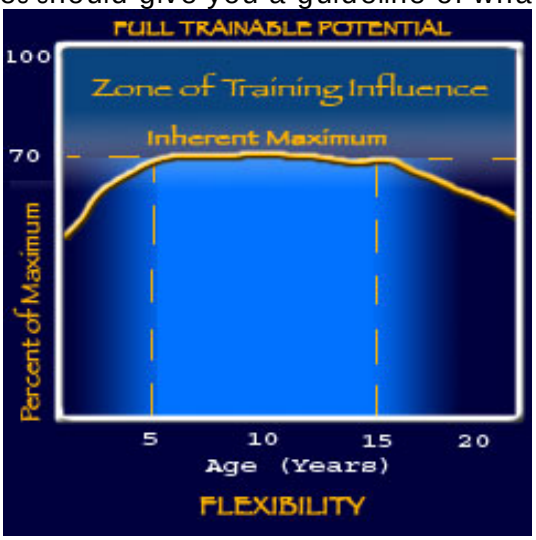
WORLD CHAMPION	NUMBER OF YEARS OF TRAINING BEFORE 1ST WORLD TITLE
Wayne Otto	8

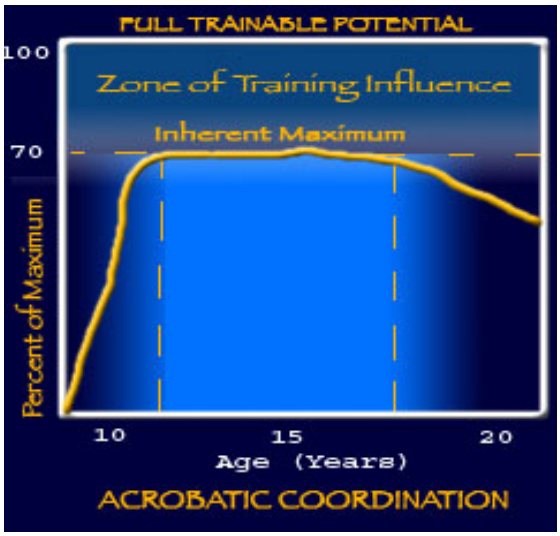
Christopher Pinna	20
Elisa Au	17

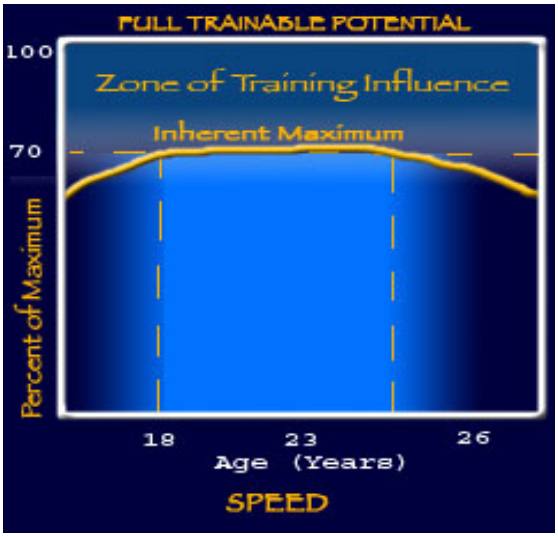
2. Karate requires mental maturity which generally is associated with age and experience in order to strategize and implement strategies.

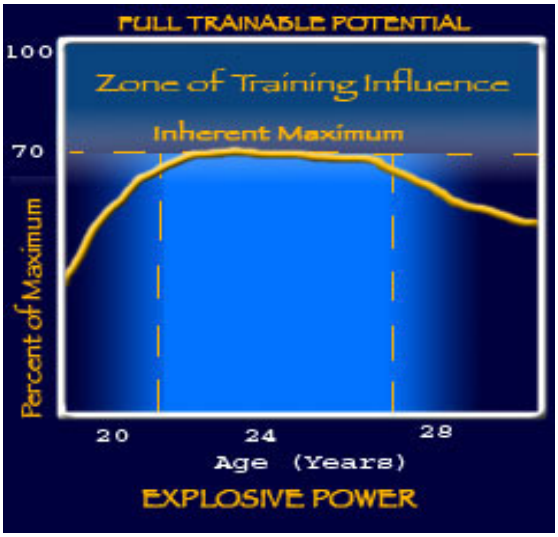
3. Physical Abilities

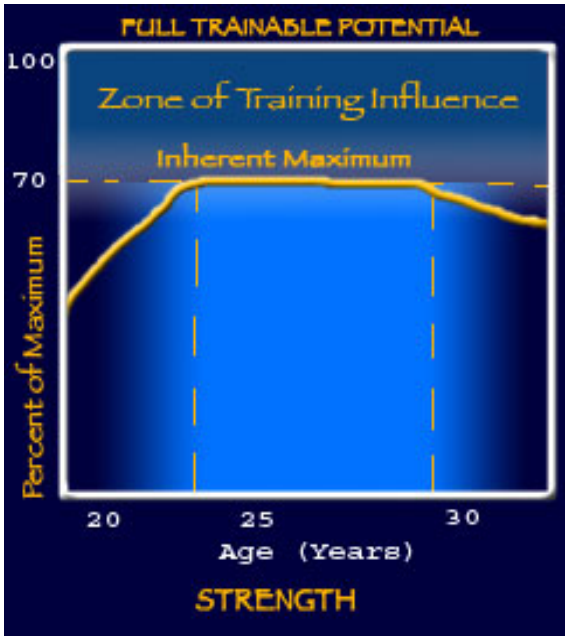
Let's next look at the peak ages for six physical attributes a karate champion needs in order to excel. In the following statistics the compiler has taken 70% as the level of ability which is inherent (born with), and 30% as the amount by which we can further enhance our abilities through training. As always, keep in mind that each individual is different and that you may peak at a different age than is the norm. However these figures should give you a guideline of what is most common.

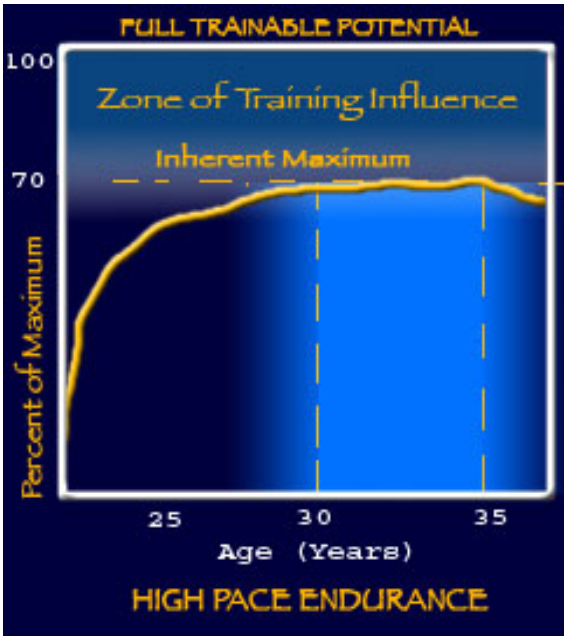












Out of the above six physical attributes, which are all necessary to one degree or other depending on the types of techniques you personally prefer to use, I would say that *Speed*, *Explosive Power*, and *High Pace Endurance* are the most crucial in winning Gold. Again, that's not to say that you don't need strength or flexibility etc... these are just the ones that in my humble opinion are the most crucial.

Now, if you look at the peak inherent age ranges for these three, you see that for the most part they mirror the statistical results shown at the top of this page for our three champs.

High Pace Endurance **and** *Overall Fitness* are extremely necessary especially as you find yourself fighting 6 fights in one day, sometimes with only a 3 minute break in between (twice that if you're fighting in multiple divisions on the same day). There is nothing worse than losing a tournament to this as its probably the easiest to enhance through proper training. I know, I've been there... got to the semi-finals of a National Championship and just ran out of steam... I had fought the preliminary rounds of the kilo division and was now fighting the Open Weight - all the same day. The worse thing was that everything else that day was dead on! I was kicking butt!!! If you lose, you want to be able to know that you did everything to prepare... otherwise there's no point stepping into the ring. This is why when we train pad sessions we do 3 minute rounds with 1 minute breaks and more rounds than you're likely to have in a tournament.

WHY DO KARATE CHAMPIONS RETIRE IN THEIR EARLY-MID 30'S?

Several reasons. The truth is that they could go on to compete and indeed win over younger athletes if they so desired. As the above charts show, although pushing their peak of *inherent* abilities, they are still not that far off the mark to not be able to make up the difference by training harder. The biggest problem is motivation! At 33, with say 6, or in the case of Wayne Otto, 9 World Titles, an athlete has little more to prove and the importance of another title is dimmed by the extra training time needed to keep themselves at the same peak level as younger athletes. As we've seen with boxers, older athletes *can* rise above the age barrier and compete successfully. Unfortunately

in Karate we don't have $20 million dollar purses to motivate the athletes to keep training and fighting. It would be nice though....

The other main reason is the accumulation of career injuries and the fact that new injuries take longer to heal with age.

BASIC PRINCIPLES FOR IMPROVING PERFORMANCE

KEY POINTS

1. For most sports, the top competitor is generally the one who can appropriately sustain the greatest power output to overcome resistance or drag.

2. It is not sufficient for championship performance to simply have the ability to produce great power. The champion must be able to sustain power output in an efficient and skillful manner for the duration of the competition.

3. During maximal exercise lasting a few seconds, the anaerobic breakdown of phosphocreatine and glycogen in muscles can provide energy at rates many times greater than can be supplied by the aerobic breakdown of carbohydrate and fat. However, this high rate of anaerobic energy production cannot be sustained for more than about 20 seconds.

4. For exercise lasting more than a few minutes, an athlete who has a high lactate threshold, that is, one who can produce a large amount of energy aerobically without a major accumulation of lactic acid in the blood, will be better able to sustain a higher rate of energy expenditure than will a competitor who has a lower lactate threshold.

5. A high level of mechanical efficiency, which is the ratio of the mechanical power output to the total energy expended to produce that power, is vital if an athlete is to make the most of his or her sustainable rate of energy expenditure. Mechanical efficiency depends upon the extent to which the athlete can recruit slow-twitch muscle fibers, which are more efficient at converting chemical energy into muscle contraction than are fast-twitch fibers.

6. Neuromuscular skill is also critical to mechanical efficiency because the more skillful athlete will activate only those muscle fibers required to produce the appropriate movements. Extraneous muscle contractions require more energy expenditure but do not contribute to effective power output.

INTRODUCTION

The criterion for success in many sports, bicycling, rowing, swimming, particularly karate, is simply the time required to propel the athlete's body (and essential equipment such as a bicycle, rowing shell, or skis) for a given distance. In the case of Olympic weightlifting and power lifting, success is determined by how much weight can be lifted in the appropriate movements, whereas a wrestler is judged by the degree of physical control over the opponent.

These sports are quite different in terms of the patterns of muscle recruitment, the force and power produced, and the equipment used; nevertheless, success in all of these seemingly diverse sports depends on a complicated application of a simple principle--the champion is the athlete best able to reduce the resistance or drag that must be overcome in competition and best able to sustain an efficient power output to overcome that resistance or drag.

This review provides an analysis of the major factors that contribute to an athlete's ability to produce power appropriately to overcome resistance or drag and a number of important applied principles designed to help trainers, coaches, physiologists, and others assist athletes in achieving their goals in sport.

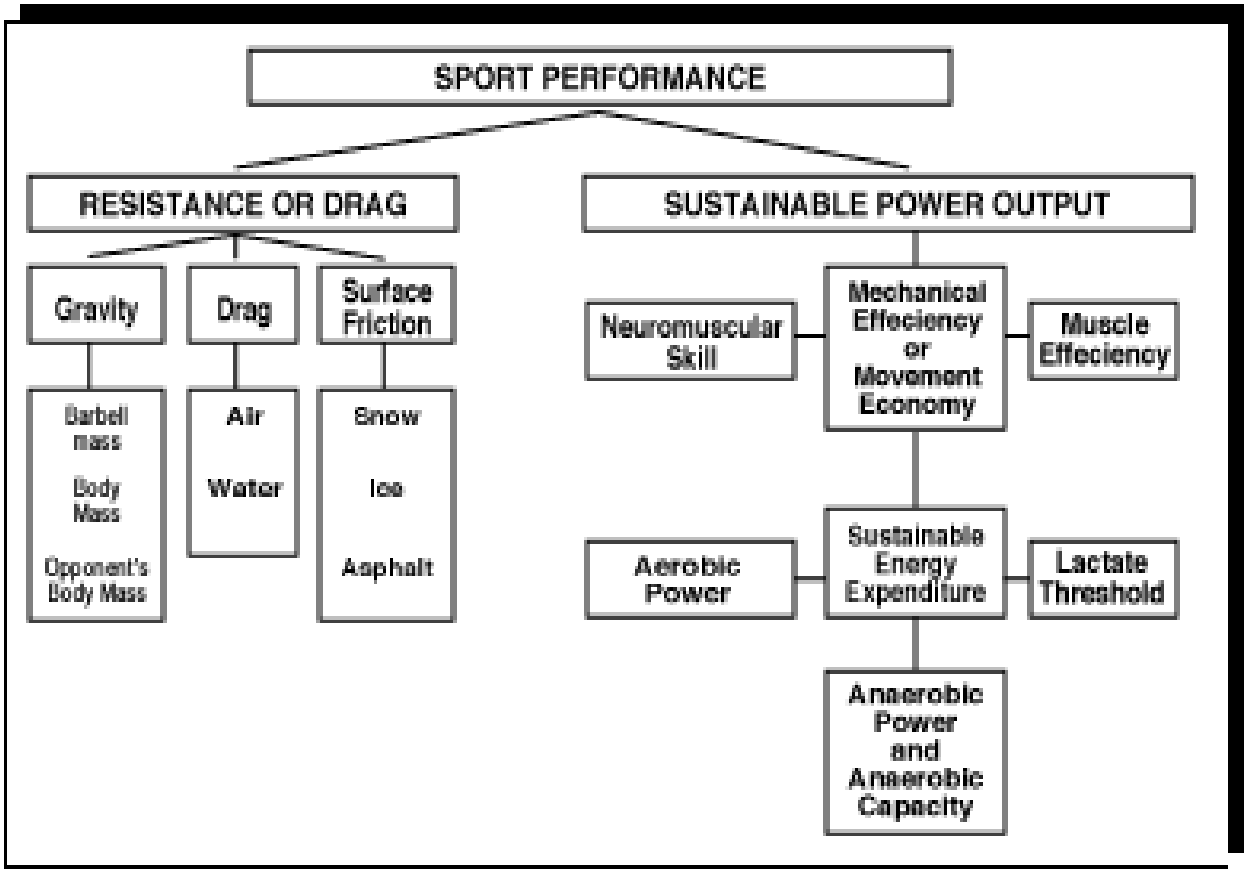


Figure 1. Mode of the interrelationship of major factors determining sport performance. Performance is determined by how effectively the athlete can sustain sufficient power output to overcome various types of resistance or drag, depending on the sport event.

Sustainable power output depends on the rate of energy expenditure that can be sustained throughout the event and the efficiency with which that energy can be converted into mechanical power.

Depending on the sport event, sustainable energy expenditure will be a function of the ability to sustain the production of energy by anaerobic and/or aerobic means. Mechanical efficiency is dependent on muscle efficiency, i.e., the efficiency with which muscles convert the energy stored in carbohydrate and fat into muscle shortening, and the neuromuscular skill with which the athlete performs the event, i.e., the degree to which the athlete has learned to recruit only those motor units required to produce maximal power output in a skillful way.

RESISTANCE AND DRAG: EXAMPLES IN SPORT

Examples of resistance in sport include the mass of a barbell in Olympic lifting or power lifting, the muscular efforts of an opponent in wrestling or judo that are used to offset the movements of a competitor, and the effect of gravity on resisting a marathon runner's ability to move up a hill. A lifter who can sustain adequate power output long enough to correctly lift a greater weight than a competitor will beat that competitor. Likewise, a competitor in wrestling or judo who can sustain power sufficient to overcome the resistance provided by the opponent throughout the match will be the winner.

Drag is a special case of resistance in which the friction of air or water around a competitor retards forward motion. Obvious examples of drag are the adverse effects of a headwind on the forward velocity of a competitive cyclist and the retarding effects of water drag on the efforts of a swimmer to move quickly ahead. In cycling on a flat course at speeds greater than 13 km/h (8 mph), most of the resistance to the power generated by a bicyclist is created by the air through which the cyclist's body moves; relatively little bicycling power is lost to friction of the moving components of the bicycle or to the rolling resistance of the contact between the tire and road (Kale, 1991). It is also important to realize that the air drag increases as the square of the velocity of the moving object, i.e., if speed is doubled, the drag increases by four-fold (Kale, 1991).

Air drag offers great resistance in any sport requiring the athlete to move at relatively high velocities; such sports include speed skating--30-40 km/h (19-25 mph) at distances of 0.5-10 km (3-6 mi)--and sprint running--25-35 km/h (15-22 mph) at distances of 100-400 m. In fact, the air creates so much resistance in speed skating that the skaters must assume a tightly crouched posture to reduce their frontal areas exposed to air. Although this posture reduces leg power, it reduces air drag to an even greater extent and thus produces higher skating velocities. Swimmers move at relatively low velocities because they encounter large drag forces from the water as well as from the turbulence at the surface of the water. This drag encountered by a swimmer is not simply a function of body mass, but also of the geometry of the body as it moves through the water.

It is obvious that in events such as bicycling, speed skating, and possibly sprint running, each of which requires the athlete to move through the air at high speeds, the ultimate race time will be determined by the power generated relative to the air resistance. The same is true for the swimmer who must overcome the drag of the water at lower

speeds. The main point is that the race velocity in these sports is a function of power production relative to the drag encountered at racing speeds. Therefore, velocity (performance) can be increased by improving power output and/or by reducing drag

REDUCING RESISTANCE AND DRAG

In some sports, such as Olympic lifting, power lifting, and the shot put, the very nature of the competition makes it impossible to reduce resistance. If a competitive lifter chooses a low resistance--a lightweight barbell, that athlete is unlikely to win the competition. Likewise, the rules do not allow a shot putter to choose a lightweight shot. However, there are methods that can be used in many sports to reduce resistance or drag. Here are a few examples:

USE SKILLFUL TECHNIQUE. Competitors in wrestling, judo, rugby, American football, and other "contact" sports can reduce the resistance applied by opponents by skillful misdirection movements that trick the opponents into resisting in the wrong direction. These techniques are learned through many years of practice under the instruction of skillful coaches.

USE AERODYNAMIC AND HYDRODYNAMIC EQUIPMENT AND BODY POSTURES. In some sports, effective techniques have been employed to reduce resistance and drag in air and water. The designs of golf balls and javelins have become more aerodynamic over the years, and the resulting reductions in air drag have improved the flight characteristics of both. In cycling, riders wear aerodynamic helmets and skintight clothing and assume crouch positions over the handle bars ("aero bars") to minimize wind resistance. In swimming, body position in the water and stroke mechanics are optimized by careful study of underwater videos so that the swimmer reduces water drag as much as possible. Also, engineers have successfully modified the designs of rowing shells, canoes, kayaks, sailboats, oars, and paddles to minimize water drag in competitive events.

REDUCE BODY MASS. Athletes should carefully consider whether they can effectively reduce resistance or drag by reducing body weight. For pole vaulters, high jumpers, long jumpers, and triple jumpers, gravity is the principal resistance that must be overcome, and body weight is responsible for nearly all of this effect of gravity. Therefore, if these athletes can reduce their body weights without equivalent reductions in their abilities to skillfully generate muscular power, their performances should improve. Of course, if the body weight loss leads to a serious loss of muscular power, performance may well be worsened, not improved. Competing at an effectively low body weight is also critical for distance runners, endurance cyclists, and cross-country skiers. In these sports, the resistance of gravity is a crucial factor in determining performance; in addition, at the higher velocities of cycling, air drag is a major type of resistance that must be overcome, and a smaller frontal body surface area can reduce that resistance.

Weight reduction is not so much of an issue in swimming because the body mass is buoyed up by being immersed in water. However, to the extent that reductions in body weight help reduce water drag, weight loss could be of benefit in swimming, too. Differences in swimmers' individual body builds could play a significant role in determining whether or not weight loss improves swim performance. For example, weight loss may be quite ineffective in a swimmer who already presents a small frontal area and who tends to lose weight mostly in the thighs. However, if a swimmer has

exceptionally large shoulders and a large chest, and if the mass of these areas can be reduced effectively through a weight loss program, such an approach could shave time off that swimmer's personal records.

PROVIDING EFFICIENT SUSTAINED POWER OUTPUT TO OVERCOME RESISTANCE AND DRAG

Power is the ability to apply force through a distance quickly. In other words, power can be thought of as a combination of strength and speed. Interestingly, the sport of power lifting is misnamed because only strength, not speed, is required to be successful; as long as the barbell is moved appropriately, time is of no importance. On the other hand, a person could have exceptionally strong leg muscles and be a pitiful high jumper, sprinter, or long jumper if that strength could not be brought to bear quickly.

Unfortunately, absolute maximal muscular power can be sustained for only a fraction of a second. Thus, assuming equal resistance or drag, the champion in a sport event will not necessarily be the competitor who can produce the greatest maximal power, but instead will be the one who can sustain the greatest power output to overcome the resistance or drag for the duration of the event. This duration may be only a second or two, such as in power lifting, or many hours, such as in an Ironman triathlon.

SUSTAINING ENERGY PRODUCTION BY THE MUSCLES

When energy requirements are extremely high, such as during a sprint in track or swimming or during an Olympic weightlifting event, most of the muscular energy is supplied by two fuels, phosphocreatine (PCr) and glycogen, that are stored in small amounts in the muscles. Because these two fuels can be broken down for energy without the use of oxygen, this is known as anaerobic (without air) energy production. Aerobic energy production occurs at a much slower rate as fats and carbohydrates are broken down with the aid of oxygen in the muscles.

Contributions of Anaerobic and Aerobic Energy During Sequential Phases of Exercise

Phase	Time	Anaerobic	Aerobic
1	0 – 30 s	80%	20%
2	30 – 60 s	60%	40%
3	60 – 90 s	42%	58%
4	90 – 120 s	36%	64%
5	120 – 180 s	30%	70%

Contributions of Anaerobic and Aerobic Energy During Cumulative Periods of Exercise

Period	Anaerobic	Aerobic
0 – 60 s	70%	30%
0 – 90 s	61%	39%
0 – 120 s	55%	45%
0 – 180 s	45%	55%

TABLE 1. Relative contributions of anaerobic and aerobic energy production during sequential phases and cumulative periods of exhausting exercise lasting 180 s. Data from Bangsbo et al. (1990)

SUSTAINABLE ENERGY EXPENDITURE IN BRIEF, HIGH-POWER EVENTS

Brief, high-power activities such as weightlifting and sprinting rely largely on the anaerobic breakdown of PCr and muscle glycogen for energy. When estimates of anaerobic energy production are coupled with simultaneous measurements of aerobic energy production, the approximate relative contributions of these two energy sources during various phases of exercise lasting from 0-180 s are as shown in Table 1. It is clear from the table that the percentage anaerobic contribution to energy production falls off
rapidly as the exercise duration increases.

Both PCr degradation and anaerobic glycolysis are activated instantaneously at the onset of high-intensity exercise. Measurements of PCr and lactate from muscle biopsies taken following as little as 1-10 s of electrical stimulation (Hultman & Sjoholm, 1983) and after sprint cycling (Boobis et al., 1982; Gaitanos et al., 1993; Jacobs et al., 1983) confirm the rapid breakdown of PCr and rapid accumulation of lactate. At the onset of less intense exercise, a similar instantaneous activation of both PCr degradation and anaerobic glycolysis occurs but at a much slower rate because the mismatch between energy demand and aerobic supply is reduced during submaximal exertion.

RATE OF ANAEROBIC ENERGY PRODUCTION DURING EXERCISE

The rate of anaerobic energy provision is critical to success in sports that require the development and short-term maintenance of high power outputs. World-class power lifters and weightlifters can produce power outputs that are 10-20 times that required to elicit the maximal rate of aerobic energy provision, which is estimated by the maximal rate at which the athlete can consume oxygen (VO2max).

However, such high power outputs can be maintained for only a fraction of a second. Sprinters can achieve power outputs that are 3-5 times the power output that elicits VO2max, but they can sustain that power output for only about 10 s. However, power output over a 30-40 s sprint can still be sustained at twice the power output at VO2max. Estimates of the rates of anaerobic provision of energy have been calculated from biochemical changes in muscles following intense exercise lasting from 1.3 to 200 s (Spriet, 1994).

These studies used non-elite athletes who performed sprint cycling, sprint running, or repeated knee extensions or who underwent electrical stimulation of their muscles. The highest measured rates for energy production from PCr and anaerobic glycolysis during various types of exercise lasting from 1.3-10 s were each approximately 250-500% of the estimated maximal rate of energy provision from aerobic metabolism. In other studies of sprint cycling for 6-10 s, energy production rates from PCr and anaerobic glycolysis combined were about 400-750% of that during maximal aerobic metabolism (Boobis et al., 1982; Jacobs et al., 1983).

The anaerobic energy provision rates decrease when averaged over longer periods of time. In studies that examined intense exercise for 30 s, the average energy provision rate from PCr was about 70-100% of that from maximal aerobic metabolism; anaerobic

glycolysis provided energy at a rate estimated to be 220-330% of that from maximal aerobic metabolism (Spriet, 1994). The large decrease in energy produced from PCr when averaged over 30 s, as compared to less than 10 s, indicates that the PCr store becomes depleted between 10 and 30 s of intense exercise. Thus, for maximal exertion lasting longer than about 30 s, it appears that only glycolysis can provide for further anaerobic energy production.

ANAEROBIC ENERGY PRODUCTION DURING INTERMITTENT HIGH-POWER EXERCISE

Many athletes repeatedly engage in bursts of high-intensity exercise with varying amounts of recovery time between exercise bouts. Examples include a wide receiver in American football, a basketball player in repeated fast break situations, or a swimmer or track athlete during interval training. Most of the energy for short bouts of high-intensity exercise is derived from anaerobic sources; therefore, the ability to recover during rest periods is essential for success in this type of activity.

Many studies have examined the performance effects of intermittent high intensity exercise, but few have examined the anaerobic metabolism associated with this type of metabolic stress. Examples of the exercise models that have been studied and provided some conclusions include: 10 bouts of sprint cycling, each lasting 6 s with rest periods of 30 s; four bouts of sprint cycling for 30 s with 4-min rest periods; and two bouts of knee extension exercise to exhaustion in 3 min with 10-60 min of recovery (Bangsbo et al., 1992; Gaitanos et al., 1993; McCartney et al., 1986). Muscle biopsy measurements demonstrated that PCr was decreased by approximately 50% after 6 s and by 75-80% during longer sprints. The PCr is quickly resynthesized during recovery, reaching 50% of rest values by 30-60 s and about 80% by 2-4 min. With repeated sprinting, energy production from anaerobic glycolysis is progressively more difficult to achieve. Presumably, the accumulation of lactic acid in the active muscles plays a major role in the inability to continue producing energy by anaerobic glycolysis.

Therefore, after repeated bursts of exercise, PCr is the only potential anaerobic energy source that can be relied upon. However, as described above, it is essential that adequate rest be provided in between intermittent exercise bouts to allow PCr stores to be replenished in the muscles.

SUSTAINED AEROBIC ENERGY PRODUCTION

The maximal rate of aerobic energy production (VO2max) can be sustained for only about 8-10 min by elite athletes. In events lasting longer than 8-10 min, the best competitor among those with similar values for VO2max is usually the one who can sustain aerobic energy production at the greatest proportion of his or her maximal rate, that is, at the greatest percentage of the VO2max.

This in turn is largely dependent on the extent to which the athlete can produce energy aerobically at a high rate without accumulating a large amount of lactic acid in the blood. In other words, the athlete who produces a large amount of lactic acid at a given speed of running, swimming, or cycling cannot continue to perform at that pace for as long as the athlete who does not accumulate as much lactic acid.

An athlete who has the ability to exercise at a high intensity before blood lactic acid begins to accumulate is said to have a high lactate threshold (Coyle et al., 1988;

Holloszy & Coyle, 1984). An athlete's lactate threshold seems to be a better indicator of endurance performance lasting 30 min to 4 h than does the VO2max (Coyle et al., 1988, 1991).

This is because the lactate threshold is a better index of the athlete's ability to sustain a high rate of energy expenditure for the duration of the competition.

ROLE OF NUTRITION IN DETERMINING SUSTAINABLE ENERGY PRODUCTION

Two nutrients, carbohydrate and water, are the dietary constituents that have repeatedly been shown to be most important for optimizing endurance performance. Muscles obviously cannot produce energy without fuels derived from nutrients obtained in the diet, and carbohydrate is an obligatory fuel for high-caliber sport performance.

It is well established that dietary carbohydrate consumption before, during, and after exercise can make an important contribution to performance. Carbohydrate consumption acts primarily by increasing the body's stores of glycogen in muscles and in the liver before exercise and by increasing the availability of glucose for use by the muscles during exercise (Coggan & Swanson, 1992; Costill & Hargreaves, 1992; Coyle, 1991; Williams, 1993). Fluid intake during prolonged exercise is also required to counteract the debilitating effects of exercise and heat on cardiovascular function and on body temperature regulation. When dehydration reduces blood volume, oxygen delivery to the muscles by the blood can be compromised, and this reduces the ability of the muscles to produce energy aerobically.

Dehydration also compromises the ability of the body to regulate its temperature, resulting in eventual lethargy and potential heat illness, both of which adversely affect the athlete's ability to sustain a high rate of energy production. Carbohydrate-electrolyte beverages are advocated as the most effective way to supply both carbohydrate and fluid to the body during exercise (Coggan & Swanson, 1992; Gisolfi & Duchman, 1992).

IMPROVING THE ABILITY TO SUSTAIN ENERGY PRODUCTION AT A HIGH RATE

Here are some ways that athletes may be able to improve their abilities to sustain high rates of energy production so they can sustain greater power output to overcome resistance and drag:

At the onset of a training season, the athlete should establish a solid aerobic training foundation by training at relatively low intensities for long durations. This will help develop a greater blood volume, an improved ability of the heart to pump blood, and better networks of capillaries in the trained muscles. These cardiovascular adaptations will lead to an improved delivery of oxygen to the muscles and an enhanced ability of the muscles to sustain high rates of aerobic energy production.

For the bulk of the athlete's training, the specific muscle groups involved in the competitive event should be overloaded, and the athlete should train at a pace or intensity similar to that used in competition (Hickson, 1977, 1985). Such training can lead to improved stores of glycogen and PCr in the trained muscles so that greater energy reserves will be present in the muscles before competition begins. Furthermore, metabolic adaptations to this type of training are likely to enhance the ability of the

muscles to utilize fat for energy and to spare muscle glycogen, resulting in less lactic acid production and less accumulation of lactic acid in the blood at a given pace or intensity (Holloszy & Coyle, 1984). This means that the athlete's lactate threshold will be increased so that aerobic energy production can be sustained longer at a greater rate than was possible before training.

During high intensity, anaerobic interval training, the duration of recovery intervals should be sufficient--usually between 30 s and 4 min--to allow the muscles to replenish most of the PCr depleted in the previous exercise interval. If these recovery intervals are too brief, the supply of PCr in the exercising muscles will be inadequate to provide energy anaerobically at a high rate (Gaitanos et al., 1993; McCartney et al., 1986). This means that the athlete will be forced to exercise at a lower intensity (slower pace) and that inappropriate muscle groups may be recruited to accomplish subsequent exercise intervals. If these events occur, the athlete will be learning incorrect movement patterns during training that may adversely affect competitive performance.

The athlete should receive adequate rest--approximately 24 h--between exhaustive training sessions to allow for total replenishment of depleted glycogen stores in the muscles prior to the next training session (Coyle, 1991). Otherwise, the quality of the next training session may be compromised because the athlete's muscles will be easily depleted of one of their main fuels. In addition, training intensity and duration should be gradually reduced during the week before a competitive event so that the athlete's energy reserves are fully loaded before competition.

The athlete should drink plenty of fluids before, during, and after exercise to avoid becoming dehydrated. Dehydration can lead to a diminished ability to deliver oxygen to the muscles, heat cramps, heat exhaustion, and even heat stroke, all of which can impair muscular energy production.

On a daily basis, the athlete should consume a diet high in carbohydrate, about 8 g of carbohydrate per kilogram of body weight (4 g/lb). This will ensure that the muscles can store extra glycogen and may help sustain energy production during competition.

Preliminary evidence suggests that dietary creatine supplementation may increase PCr stores in muscles (Dalsom et al., 1995) and perhaps improve performance in events such as fastbreak basketball that require repeated brief exertions. The extent to which creatine supplementation proves to be useful in actual sport settings remains to be seen.

During prolonged exercise, the athlete should consume carbohydrate-electrolyte drinks containing approximately 6% carbohydrate (glucose, sucrose, or maltodextrins) and a small amount of sodium to help maintain an adequate carbohydrate energy supply to the muscles and to minimize dehydration. Volumes of 150-250 mL (5-8 oz) should be consumed every 15-20 min to replace most, if not all, of the sweat lost by the athlete during exercise (Montain & Coyle, 1992).

MECHANICAL EFFICIENCY: A MAJOR DETERMINANT OF EFFECTIVE POWER OUTPUT

Mechanical efficiency for a sporting event is the ratio of the mechanical power output to the total energy expended to produce that power. Typically, both power output and energy expenditure are expressed in watts (W), and the ratio is expressed as a

percentage. For example, if a cyclist expends energy at the rate equivalent to 5 L of oxygen per minute (1745 W) to produce 400 W of power on a bicycle ergometer, the mechanical efficiency would be (400/1745) 100 = 23%.

Two of the principal factors that determine the mechanical efficiency of an athlete in a sport event are 1) the efficiency with which the active muscles convert the chemical energy stored in carbohydrate and fat to the mechanical energy required to shorten the contractile elements in the muscles, and 2) the neuromuscular skill with which the athlete performs the event.

IMPROVING THE ATHLETE'S ABILITY TO PROVIDE POWER OUTPUT IN AN EFFICIENT MANNER

There is little that the athlete can do to improve muscle efficiency because the chemical efficiency of converting fuels to ATP and the proportion of slow-twitch fibers involved in various movements are largely determined by heredity. An exception may be that athletes over many months of training may learn to recruit more of the efficient slow-twitch muscle fibers and fewer of the less efficient fast-twitch fibers. In addition, there are three important steps that can be taken to improve the skill with which power output is applied.

The athlete should obtain the technical advice of competent coaches who can explain how movement patterns should be altered to become more skillful. Often the coach can rely upon personal experience and observation to make critical improvements in an athlete's technique.

Video analysis of the athlete's performance can provide clues about changes in movement patterns that can be made to improve efficiency. The assistance of a sport biomechanist or a coach well-educated in biomechanics could be important in this phase of the athlete's preparation.

The athlete must repeat the appropriate movement patterns in a skillful manner many thousands of times during practice so the nervous system learns to perform the movement correctly every time throughout the entire duration of competition. There is no substitute for skillful repetition of muscular activities to ensure that such activities are likely to remain skillful in the heat of competition.

SUMMARY

For most competitive sports, improving the performance of an athlete can be accomplished by reducing the resistance or drag that must be overcome or by increasing the athlete's ability to sustain a high power output to overcome that resistance or drag. Reducing air resistance or water drag typically involves improving body position in the air or water by minimizing the frontal surface area of the athlete that is exposed to the air or water.

Sometimes the apparel or equipment used in the sport, e.g., helmets, swimwear, bicycles, and rowing shells, can be made more aerodynamic or hydrodynamic to reduce resistance or drag.

Increasing sustainable power output requires that the athlete undergo a carefully designed training program that will improve the athlete's abilities to: 1) produce

metabolic energy by both aerobic and anaerobic means, 2) sustain aerobic energy production at high levels before lactic acid accumulates excessively in the blood, 3) recruit more of the efficient slow-twitch muscle fibers at exercise intensities used in competition, and 4) become more skillful by recruiting fewer non- essential muscle fibers during competition. Careful attention to maintaining a sufficient intake of fluids and carbohydrate before, during, and after strenuous competition and training sessions is also important.

Although it is apparent that some uniquely gifted athletes are able to win consistently even when their approaches to training are obviously not optimal for reducing resistance or drag and for enhancing their sustainable power outputs, it is clear that such athletes cannot achieve their full potentials in sport without addressing these two basic principles.

SPORTS PSYCHOLOGY

Sport psychology is the science of behavior applied to exercise and sport participation. Increasing numbers of athletes and coaches are using sport psychologists to help them gain a personal and competitive edge--to manage stress and anxiety more effectively, improve concentration and motivation, increase confidence, and promote better communication. This field has been percolating for 70 years, yet many people still think of it as commonsensical mind games.

A right mindset is one of the determinants of an athlete's performance, right along with his or her physical condition and technical skills. Just as there is a set of well-known physical characteristics of a champion (i.e., strength, speed, and stamina), there is a set of mental factors identified as part of a winner's mindset.

They are confidence, concentration, consistency and control. Mindset is important for several reasons. It is often the factor that sets apart the best from the good. Research has revealed that at least 50 percent of athletic performance successes and even more athletic performance errors and failures are due to mental factors.

Often times, talents plus physical and technical training can take athletes and teams only so far before they reach a performance plateau. It is mental training that will carry them to the next level. In their practices, sport psychologists apply many psychological principles, such as behavioral analysis, anxiety, arousal, attention, motivation, aggression, personality assessment for individuals, and leadership and cohesion for teams. The specific techniques used by sport psychologists include the following:

- **Autogenic Training:** *Learn about personal physiological responses to stress in order to control those responses.*
- **Imagery/Simulation:** *Mentally rehearse your performance, in details.*
- **Positive Visualization**: *Try to "see" yourself win, in your mind.*
- **Relaxation Training**: Use *relaxation methods to help with consistency & performance.*
- **Concentration Training**: *Learn to tune out distracters and develop focusing strategies.*
- **Positive Thought Training/Cognitive Restructuring**: *Change thinking patterns: Catch negative thoughts and stop them; think positive instead.*
- **Confidence Training**: *Develop your own way of building confidence.*
- **Emotion Regulation Training**: *Learn to regulate emotional responses to situations during competitions.*

- **Goal Setting**: *High but attainable goals often best motivate athletes.*

- **Team Building**: *Identify leadership and foster team cohesiveness.*

Many athletes have benefited from working with sport psychologists in achieving peak performance, as well as in improving and maintaining mental health. Currently, every US Olympic team and many major college athletic departments have sport psychologists available to work with their athletes and teams.

WHAT IS THE CURRENT STATE OF SCIENCE THAT SUPPORTS THE USE OF PSYCHOLOGICAL INTERVENTIONS TO IMPROVE SPORT PERFORMANCE?

Williams: Individual variation certainly exists. However, a review of peak performance literature clearly indicates that successful athletes tend to have higher levels of self-confidence, a more task-oriented focus of concentration, a lesser likelihood of becoming distracted, a greater ability to keep anxiety at facilitative levels, a more positive preoccupation with sport (imagery and thoughts), and more determination and commitment compared to less successful athletes. These psychological characteristics can be developed through appropriate psychological interventions. Using meta-analytic procedures, reviewers of intervention research found support for mental rehearsal (imagery), cognitive restructuring interventions, goal setting, and relaxation interventions to improve athletic performance in diverse sports such as golf, karate, skiing, tennis, and baseball.

UNDER WHAT CIRCUMSTANCES, IF ANY, CAN PSYCHOLOGICAL INTERVENTIONS LEAD TO MORE HARM THAN GOOD FOR ATHLETES?

Dr. Kirschenbaum: Psychological interventions can have a negative impact on performance under certain conditions. For example, some research indicates that focusing on details of a technique when performing complex motor movements can sometimes decrease performance. Having athletes concentrate on how their hands are moving or their swing is taking shape could lead to at least a temporary interference in smooth motor performance.

Thus, if a sport psychologist encourages athletes to focus on microscopic aspects of their performance he or she can adversely affect athletic performance.

It may also be harmful for sport psychologists to encourage all athletes to try to attain a certain level of calm before performing. Certain sports and certain movements within sports generally require a higher level of activation. Also, some athletes tend to respond at their best when they are at high levels of activation or arousal.

Competent sport psychologists are likely to observe and closely evaluate the effects of their interventions with athletes. If the intervention appears to be doing more harm than good, the psychologist should be able to recognize this, and make adjustments accordingly.

THE CHILD ATHLETE

More young people enjoy sports than ever before. Athletic participation has increased in grade schools, high schools and community programs.

Young athletes have special needs. Because their bodies are growing, they often require different coaching, conditioning, and medical care than more mature athletes. It is important to examine the special requirements of young athletes to better prepare them for the competitive pressures and physical injuries that can come with increased sports activity.

Statistics demonstrate the increased popularity of sports among young people. Fifty percent of boys and 25 percent of girls between the ages of eight and 16 compete in an organized sports program sometime during the year. Three-fourths of junior high schools and middle schools have competitive interscholastic sports programs. At the high school level, there are 32 male and 27 female competitive sports with 7,000,000 high school students participating. Beyond organized sports programs, millions more compete and participate in physical education classes, church and community intramural programs, and other recreational athletic activities.

A host of factors has contributed to the awakening of interest in health, conditioning and sports. The media impact on youth has elevated talented college and professional athletes to heroic levels. The multimedia message on these sports heroes may confuse young athletes by creating unrealistic expectations. The early return to competition by professional athletes following an injury creates the impression that athletes often heal faster than the rest of us. However, peer pressure and the economic and social forces exerted on school coaches to win may lead to decisions that are not truly in the best interests of a child's health, growth and development.

YOUNG ATHLETES ARE DIFFERENT

The growing athlete is not merely a smaller version of the adult. There are marked differences in coordination, strength and stamina between a youth and an adult. In young athletes, bone-tendon-muscle units, growth areas within bones, and ligaments experience uneven growth patterns, leaving them susceptible to injury.

Increases in body size may be due to fat and not muscle, causing marked differences in strength. Too often unfair competition occurs between boys of 100 pounds of baby fat and peach fuzz versus 200 pounds of muscle and mustache.

Grade school students are less likely to suffer from severe injury because they are smaller and slower than older athletes; when they collide or fall, the forces on their musculoskeletal system are usually not high enough to cause injury. On the other hand, high school athletes are bigger, faster, stronger and capable of delivering tremendous forces in contact sports. Coaches bear a prime responsibility in developing their young athletes and watching for early signs of physical problems (such as pain or limp). They often recognize severe injuries because their athletes show signs of pain and can't continue playing.

Coaches may have more difficulty spotting less severe injuries, however, because the pain is low grade and the athlete often ignores it. Repeat injuries may turn into overuse conditions which can put the athlete on the sidelines for the rest of the season.
Many sports injuries in young athletes, particularly elbow and knee injuries, are caused by excessive, repetitive stress on immature muscle-bone units. Such repetitive overuse can cause fractures, muscle tears or bone deformity Fortunately, such injuries are uncommon, and usually prolonged pain is an early warning sign.

Coaches, parents and players should provide protection for the young athlete through proper conditioning, prompt treatment of injuries and rehabilitation programs. Conditioning programs usually strive to make the young athlete "physically fit" by improving muscle strength, endurance, flexibility, and cardiorespiratory fitness.

The coaches and parents also are responsible for creating a psychological atmosphere that fosters self-reliance, confidence, cooperation, trust and a positive self-image. Young athletes must learn to deal with success and defeat in order to place events in a proper perspective. Some coaches and parents go too far in analyzing player performance. The promotion of the "win at all costs" ethic has both short-term and long-term detrimental effects on impressionable young people.

SOFT TISSUE INJURIES

Fortunately major sports-related injuries are rare in young people. About 95% of sports injuries are due to minor trauma involving soft tissues-bruises, muscle pulls, sprains (ligaments), strains (muscles and tendons), and cuts or abrasions. Little sports time is lost from these injuries. Moreover, sports injuries occur more frequently in physical education classes and free-play sports than in organized team sports. Minimal safety precautions and supervision can prevent many injuries.

SPRAINS

Almost one-third of all sports injuries are classified as sprains. A sprain is a partial or complete tear of a ligament, which is a tough band of fibrous connective tissue that connects the ends of bones and stabilizes the joint. Symptoms include the feeling that a joint is "loose" or unstable; an inability to bear weight because of pain; loss of motion; the sound or feeling of a "pop" or "snap" when the injury occurred, and swelling. Not all sprains produce pain, however.

STRAINS

A strain is a partial or complete tear of a muscle or tendon. Muscle tissue is made up of cells that contract and make the body move. A tendon consists of tough connective tissue that attaches muscles to bones.

CONTUSIONS

The most common sports injury contusions (bruises) rarely cause a student athlete to be sidelined. Bruises result when a blunt injury causes underlying bleeding in a muscle or other soft tissues.
Prompt treatment for soft tissue injuries usually consists of rest, applying ice, wrapping with elastic bandages (compression), and elevating the injured arm, hand, leg or foot.

This usually limits discomfort and reduces healing time. Proper first aid will minimize swelling and help the physician establish an accurate diagnosis.

SPINAL CORD INJURIES

Although spinal cord injuries in sports are rare, ten percent of all spinal injuries occur during sports, primarily diving, surfing and football. They can range from a sprain to paralysis in the arms and legs (quadriplegia) to death. Participants in contact sports can minimize the risk of minor neck spinal injuries-sprains and pinched nerves-by doing exercises to strengthen their neck muscles.

SKELETAL INJURIES

A sudden, violent collision with another player, an accident with sports equipment or a severe fall can cause skeletal injuries in the growing athlete, including fractures.

Fractures constitute a low five to six percent of all sports injuries. Most of these breaks occur in the arms and legs. Rarely are the spine and skull fractured.

More common, however, are stress fractures and ligament-bone disruptions that occur because of continuing overuse of a joint. The main symptom of a stress fracture is pain. Frequently, initial x-rays do not show any signs of a stress fracture so the athlete is permitted to return to the same activity. Unfortunately the pain often returns or continues, but the athlete keeps playing. The most frequent places stress fractures occur are the tibia (the larger leg bone below the knee), fibula (the outer and thinner leg bone below the knee), and foot.

"Little League elbow" can result when a pitcher's repetitive throwing puts too much pressure on the elbow bone's growth centers. This painful condition results from over usage of muscles and tendons or from an injury to the cartilage surfaces in the elbow.

In the growing athlete's musculoskeletal system, pain from repetitive motion may appear somewhere besides the actual site of the injury. For instance, a knee ache in a child or adolescent may actually be pain caused by an injury to the hip.

DIAGNOSIS AND TREATMENT

Diagnosis of any sports-related orthopaedic injury should be made promptly by orthopaedic surgeons, physicians who specialize in the care of the musculoskeletal system. The physician usually will ask the young athlete how the injury occurred, then follow with questions about the type of pain-whether it is a stabbing pain, a dull ache or throbbing-the location of the pain, and the sport in which the athlete was involved.

During the physical examination, the orthopaedist will ask the athlete to move the affected area to determine whether the child's motion has been affected. The orthopaedist will gently touch the area to observe for obvious skeletal abnormalities. X-rays or other radiographic tests may be ordered, depending on the athlete's condition and the doctor's need for additional information.

Orthopaedic surgeons have been in the forefront of treating musculoskeletal system injuries and have a long tradition of caring for young athletes. In the last two decades, they have analyzed and clarified young athletes' psychological needs, conditioning, training, and susceptibility to physical injury. They provide early and comprehensive care of orthopaedic injuries. This can help young athletes heal and return to competition with less chance of repeated injury.

Treatment varies according to the patient's condition, but it may include bed rest, elevation, compression bandages, crutches, cast immobilization or physical therapy.

FEMALE ATHLETES

Female involvement in sports has increased tremendously at the high school level-by 700% over the last 15 years. Although early studies indicated that female athletes needed to train at lower levels of intensity than male athletes, it appears that this was more a social than a physiological problem. Today's female athlete is able to train and frequently compete at levels that rival many of the best male athletes. Although there are differences in performance that are sex-related, athletic injuries are related more to the player's sport than sex.

RISK AND BENEFITS

Sports activity by young people is generally safe with low risks and high benefits. The major goal should be enjoyable participation. Exposure to competitive and noncompetitive sports encourages the development of fitness, motor skills, social skills and life-long appreciation for sports.

Your orthopaedist is a medical doctor with extensive training in the diagnosis, and non-surgical and surgical treatment of the musculoskeletal system, including bones, joints, ligaments, tendons, muscles and nerves.

THE SENIOR ATHLETE

PSYCHOLOGICAL HURDLES OF AGING AND EXERCISE

Why do we appear to get lazy in our old age? There are a number of factors to consider here. First, and probably most important, is that you've been training for so long that it's getting boring. If you were a competitive athlete and have retired, there is no more drive to win edging you on to work out regularly.

In short you're suffering a motivational deficit - that's me trying to talk fancy... you basically have little reason to do it anymore. Lets face it, while some of us may enjoy working out, we all realise that a regular routine requires discipline, and yes, motivation. That which used to be your driving force, winning medals or just being the best at what you do, is no longer there to push you.

The second reason is peer presure. Unless you hang out with a bunch of retired athletes like yourself, you're more than likely to be surrounded by people of your age who are not in shape, probably never have been, and don't put much value in being so. Despite the fact that *you* know the value of fitness, being a human being, the most adaptable creature on earth, you will be susceptible to following the crowd... blending with your environment, especially if its the "easy" thing to do. Unfortunately exercise begets energy. So if you don't exercise regularly you will become lethargic making the prospect of exercise less appealing, and thus a vicious circle is formed.

So how do you battle these forces of flabby evil? Well first off, hopefully your years as an athlete have made you a maverick and not a sheep. Secondly, you will have grown to love what your body can do when its well tuned and find it unbearable to settle for rolls of fat and breathing heavily after climbing a short flight of stairs. You will hopefully have developed a level of self esteem which will not allow you to let yourself go. Make no mistake, this is *not* vanity! It's self-respect.

You need to understand that you no longer need to work out 3-4 hours a day to stay fit. You can get away with far less as long as its regular. Next, now that you're retired from your sport, explore other sports. Try some you either didn't have time to do while competing or feared would counter act specific muscle development you had mapped out for your primary sport's needs. Variety is the spice of life. Mix it up and you won't get bored. Ultimately, this will ensure that you stay fit and healthy.

HOW AGING AFFECTS FLEXIBILITY

With appropriate training, flexibility can, and should, be developed at all ages. This does not imply, however, that flexibility can be developed at the same rate by everyone. In general, the older you are, the longer it will take to develop the desired level of flexibility. Hopefully, you'll be more patient if you're older.

According to M. Alter, a leading expert, the main reason we become less flexible as we get older is a result of certain changes that take place in our connective tissues. As we

age, our bodies gradually dehydrate to some extent. It is believed that "stretching stimulates the production or retention of lubricants between the connective tissue fibers, thus preventing the formation of adhesions". Hence, exercise can delay some of the loss of flexibility that occurs due to the aging process. Dr. M. Alter further states that some of the physical changes attributed to aging are the following:

- An increased amount of calcium deposits, adhesions, and cross-links in the body
- An increase in the level of fragmentation and dehydration
- Changes in the chemical structure of the tissues.
- Loss of "suppleness" due to the replacement of muscle fibers with fatty fibers.

This does *not* mean that you should give up trying to achieve flexibility if you are old or inflexible. It just means that you need to work harder, and more carefully, for a longer period of time when attempting to increase flexibility. Increases in the ability of muscle tissues and connective tissues to elongate (stretch) can be achieved at any age.

OLDER ATHLETES : EXERCISE IN HOT ENVIRONMENTS

1. Epidemiological accounts of heat wave statistics and some laboratory studies have indicated that individuals over the age of 60 are less heat tolerant than younger individuals. It has also been suggested that older men and women are limited in their ability to exercise in hot conditions.

2. The above conclusions are not supported by research performed on older athletes. When healthy regular exercisers 55-70 years old are compared with young adults of similar aerobic fitness, acclimation state, body size, and body composition, both groups respond with similar rates of heat storage and similar body core temperatures during exercise in the heat. Likewise, older athletes and young adults are equally capable of acclimating to exercise in the heat.

3. Primarily because of age-related changes in control of blood flow to the skin, there are subtle differences in the way older athletes and young adults respond to exercise in the heat.

4. While fluid consumption is important for people of all ages before, during, and after exercise in hot conditions, adequate fluid intake should be particularly emphasized for older exercisers.

5. Aerobic fitness, acclimation, and hydration state are far more important in determining successful ability to exercise in hot environments than is age.
Aging is often associated with decreased physiologic function, including a decreased ability to regulate body temperature effectively during heat stress. Proponents of this belief point to epidemiological studies which consistently show a relationship between age and morbidity and mortality during climatic heat waves.

Furthermore, many laboratory studies have demonstrated that older individuals respond to an imposed heat challenge with higher core temperatures and heart rates, lower sweating rates, and a greater loss of body fluid compared to younger individuals. What is not clear, however, is whether chronologic age per se causes poor heat tolerance or whether other factors which change concomitantly with advancing age play a larger role than age itself.

When dealing with exercise and heat tolerance in older individuals, it is important to understand clearly the questions being posed. Whether the "average" 65-year-old is at greater risk of heat illness during sustained activity than the "average" 25-year-old is a distinctly different question than "Is the fit, healthy, older athlete at greater risk of heat illness than an average 25- year-old?" This latter question relates directly to a basic physiological question, "Are there inevitable or irreversible age-related changes that diminish heat tolerance?"

DIET AND HEALTH

WHY IS WEIGHT MANAGEMENT IMPORTANT?

Proper diet and a good conditioning program play a vital role in athletic performance. Athletes who are under their ideal playing weight will not perform as well as they may at their ideal weight.

WHAT ABOUT FAD DIETS AND CRASH DIETS?

Fad diets are popular because they promise rapid weight loss. However, fad diets and crash diets actually result in a loss of lean muscle mass, water, and stored energy, not a loss of excess body fat. As a result, most athletes on such diets become tired early in the day (or game) and have a hard time finding the energy they need.

HOW DOES WEIGHT LOSS OCCUR?

How many calories you need depends on your age, sex, weight, and activity level. To maintain your weight, you have to take in the same number of calories that you burn. It takes about 3,000 calories a day for the average 165-pound man who is 19-24 years old to maintain his weight. From ages 25-49, the daily calorie requirement drops to 2,700. An average 127-pound woman, 19-24 years old, will have to consume 2,100 calories daily for weight maintenance. From ages 25-49, this figure drops to 1,900 calories per day. Your body weight will change when there is a difference between calories in and calories out.

HOW CAN I LOSE WEIGHT?

To lose weight you must eat less, exercise more, or both. Combining diet with exercise is a healthier, more balanced, and more successful way of losing weight than by dieting alone. One pound of body weight is equal to 3,500 calories. Eating 500 fewer calories per day will result in a weight loss of one pound per week. Eating 250 fewer calories per day combined with a 250 calorie deficit from exercise will also result in a weight loss of one pound per week. Athletes should lose no more than 2 to 3 pounds per week.

EXERCISE

You should exercise 3 to 6 times per week for 30 to 60 minutes at 60% to 80% of your maximum heart rate. The goal is to expend at least 300 calories per exercise session. This would be about a 3 mile jog, 12 mile bicycle ride, or a 1 mile swim. See the chart below for more examples of calories burned during different types of exercise. Calories may also be burned off during the day by:

- taking the stairs instead of using elevators
- park farther away from the store and walk briskly through the parking lot
- do your errands on foot or on bicycle instead of driving

To lose weight safely, it is important to eat a wide variety of foods. You should eat enough carbohydrates to fuel your body for exercise. You should reduce your fat intake to reduce calories, rather than follow a very low calorie diet. Because everyone is different, there are no general guidelines as to how much or how little you should eat or exercise. Use the charts below to help guide you in your food choices

Athletes are always looking for a secret edge against the competition and what an athlete chooses for fuel can help. Because sports nutrition is an evolving area of sports science, it is prone to myths and misconceptions. You've probably heard all of these myths, but do you know the real facts?

HIGH CARBOHYDRATE DIETS ARE ESSENTIAL

Glycogen is a stored form of carbohydrate found primarily in muscle and in the liver. As seen above, after 2-hour exercise sessions on 3 consecutive days, athletes who consumed a high-carbohydrate diet virtually refilled their muscle glycogen stores daily. A lower-carb diet prevented athletes from adequately replenishing muscle glycogen in time for the next training session.

CARBOHYDRATES BEFORE AND DURING EXERCISE IMPROVES HIGH-INTENSITY EXERCISE CAPACITY

Individuals undergoing 1-minute cycling sprints followed by 3 minutes of rest, continuously, until exhausted, were tested when consuming water or, when given a carbohydrate sports drink (Gatorade ®). The carbohydrate helped athletes improve the duration of exercise by performing 7 additional 1-minute cycling sprints.

STOP & GO SPORTS

Sprinting is a component of virtually every sport and causes a rapid depletion of muscle glycogen. A single 30-second sprint can reduce muscle glycogen up to 27%. (3) After two 30-second sprints, it can drop as much as 47%. (4) By consuming a high-carbohydrate diet, performance of repeated sprints is improved due to increased energy reserves.

ENDURANCE SPORTS

During prolonged exercise, carbohydrate ingestion has been shown to blunt hormones (5) that might cause fatigue. The benefits may include: a reduced sense of effort, improved motivation, and better mood.

STRENGTH SPORTS

Athletes who strength train should increase the amount of complex carbohydrates and healthful protein sources in the daily diet to achieve added muscle. (7) Complex carbohydrates, such as breads, cereals, rice and pasta, provide healthful sources of energy for the strength-training muscle. This is a simple chart to give you a very basic idea of some of the benefits of specific foods. I will add and possibly modify some as time goes by and I receive new information.

NUTRITION AND FITNESS MYTHS

MYTH # 1: SUGAR SHOULD BE AVOIDED BEFORE TRAINING AND COMPETITION

Sugar eaten before competition increases blood levels of glucose and insulin, which is not a bad thing. Sugar is a type of carbohydrate. Carbohydrate, whether in food or drink, taken before exercise can improve performance. An athlete who is not fueled is a tired athlete who can't perform at his or her best.

MYTH # 2: SPORTS DRINKS ARE ONLY NEEDED FOR EXERCISE LASTING AN HOUR

Sports drinks can be beneficial in activities that last less than one hour, especially if the exercise is intense or occurs in hot, humid conditions. Professional athletes aren't the only ones who benefit from sports drinks. Competitive athletes who play football, soccer, tennis, field hockey or basketball can benefit from the carbohydrate and electrolytes in sports drinks. Drinking sprots drinks encourages athletes to drink more, which is important sicne dehydration can occur in exercise lasting less than one hour. Using sports drinks is an easy way to improve performance and fight dehydration.

MYTH # 3: BODY IMAGE DISTORTION IS ONLY A WOMEN'S ISSUE

Men are increasingly exposed to super male images--from the bodies of professional wrestlers to the covers of men's magazines. Men are increasingly dissatisfied with their body's appearance. Body dysmorphic disorder, the preoccupation with an imagined or slight defect in one's appearance, is recognized as a psychological disorder. Many coaches and athletes may be unaware that it occurs in both males and females.

MYTH # 4: VITAMINS AND MINERALS GIVE ATHLETES EXTRA ENERGY

Vitamins and minerals act as co-factors to unlock the chemical energy stored in food, but by themselves they do not give an athlete extra energy. A meal plan rich in grains, vegetables, fruits, meat and dairy give athletes energy. This food is also a vehicle of entry for the vitamins and minerals the body needs to unlock food energy. A multi-vitamin mineral supplement might be necessary for some athletes, but by itself, it will not provide extra energy.

MYTH # 5: IDEAL RATIO OF NUTRIENTS IS 40% CARBOHYDRATE, 30% PROTEIN & 30% FAT

Some diet plans recommend that 40% of energy come from carbohydrate, 30% protein, and 30% fat. Diets with these ratios can be detrimental to performance because they are low in calories and carbohydrates. Research shows a better diet plan for athletes is one that provides roughly 55% to 58% energy from carbohydrate, 12% to 15% protein and 25% to 30% fat.

MYTH # 6: SUGAR CAUSES DIABETES

The most common nutrition myth is probably that sugar causes diabetes. If you have diabetes, you do need to watch your sugar and carbohydrate intake, with the help of your Registered Dietitian, to properly manage your blood sugar level. However, if you do not have diabetes, sugar intake will not cause you to develop the disease. The main risk factors for Type 2 diabetes are a diet high in calories, being overweight, and an inactive lifestyle.

MYTH # 7: ALL FATS ARE BAD

It's a long-held nutrition myth that all fats are bad. But the fact is, we all need fat. Fats aid nutrient absorption and nerve transmission, and they help to maintain cell membrane integrity - to name just a few of their useful purposes. However, when consumed in excessive amounts, fats contribute to weight gain, heart disease and certain types of cancers. Not all fats are created equal. Some fats can actually help promote good health, while others increase the risk for heart disease. The key is to replace bad fats (saturated fats and trans fats) with good fats (monounsaturated fats and polyunsaturated fats).

MYTH # 8: BROWN EGGS ARE MORE NUTRITIOUS THAN WHITE EGGS

Contrary to a widely believed nutrition myth, eggshell color has nothing to do with the quality, flavor, nutritive value, cooking characteristics, or shell thickness of an egg. The eggshell color only depends upon the breed of the hen. According to the Egg Nutrition Council, "white shelled eggs are produced by hens with white feathers and white ear lobes and brown shelled eggs are produced by hens with red feathers and red ear lobes. There is no difference in taste or nutrition content between white and brown colored eggs".

MYTH # 9: SKIPPING MEALS CAN HELP LOSE WEIGHT

If you skip a meal, your body will think that you are in starvation mode and therefore slow down the metabolism to compensate. You then tend to overeat at the next meal. Often, skipping a meal and then eating too much at the next one means that you have a higher total caloric intake than if you just ate more frequently throughout the day.

MYTH # 10: AVOID NUTS AS THEY ARE FATTENING

Yes, it's true that nuts are quite calorically dense. Fifteen cashews, for instance, deliver 180 kilo calories! On top of that, it is very tough not to overeat these tasty snacks. But if you can restrain yourself from overeating them, nuts can be a part of a healthy diet. It's a nutrition myth that nuts should be avoided. In fact, nuts are high in monounsaturated and polyunsaturated fats (the good fats) as well as plant sterols, all of which have been shown to lower LDL cholesterol. In 2003, the FDA approved a health claim for seven kinds of nuts stating that "scientific evidence suggests but does not prove that eating 1.5 ounces (45 grams) per day of most nuts as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease." Instead of simply adding nuts to your diet, the best approach is to eat them in replacement of foods high in saturated fats.

MYTH # 11: CONSUMING EXTRA PROTEIN IS NECESSARY TO BUILD MUSCLE MASS

Contrary to claims of some protein supplement companies, consuming extra protein does nothing to bulk up muscle unless you are also doing significant weight training at the same time. Even then the increased requirement can easily come from food. A potential problem with supplements is the body has to work overtime to get rid of excess protein, and can become distressed as a result.

MYTH # 12: PRESERVATIVES ARE BAD FOR YOU

Not true. Without preservatives our food chain would be not be as safe as it is today. Nitrates and nitrites used in processed meats protect against the deadly Clostridium botulinum, bacteria while mould inhibitors used in cereals help to stop the growth of potential carcinogens that could otherwise lead to stomach cancer.

MYTH # 13: TO LOSE WEIGHT, BECOME A VEGETARIAN

As with most styles of eating, whether you eat meat or choose to exclude all animal products from your diet, the particular food choices you make determine whether the diet is high, low or well balanced as far as calories are concerned. Many vegetarian foods such as vegetarian cheeses and margarine, nuts, seeds and pastry made from flour and vegetarian spreads are relatively high in fat. If you concentrate on these without balancing them out with starchy carbohydrates such as bread, rice, pasta, other cereals, fruits and vegetables, you could find that your weight actually starts to creep up, not down. Simply becoming a vegetarian is not a guaranteed fast route to weight loss. Always read the label for nutritional information (on energy and fat per serving/100 grams).

MYTH # 14: DRINKING COFFEE IS BAD FOR YOUR HEALTH

No. “The evidence does not support the belief that caffeinated beverages, including coffee, cause dehydration,” says Alice Lichtenstein, director of the Cardiovascular Nutrition Lab at the Jean Mayer Human Nutrition Research Center on Aging at Tufts University in Boston. The reason for this belief is that many people think their morning coffee acts as a potent diuretic. Actually, when you down a cup of coffee, you don’t excrete any more fluid than you would from drinking one cup of water, says Christine Gerbstadt, M.D., a media spokesperson for the American Dietetic Association. Likewise, it has long been thought that coffee, as a stimulant, would lead to various forms of heart disease. The recent literature. however, suggests that coffee is safe in moderate doses. Recently, one researcher, Warren G. Thompson, M.D., noted in a 1994 literature review on this subject: "The largest and better studies suggest that coffee is not a major risk factor for coronary disease.”

MYTH # 15: EXERCISE WILL MAKE YOU LOSE WEIGHT AND CURE OBESITY

The fact is that the obese get a lot of exercise simply by hauling those extra pounds of fat around with them all the time. They huff and puff simply to haul the extra 100 pounds up a flight of stairs. Thin people who are screaming at fat people to exercise more should strap on 100 pounds of lead weight and haul it around 24 hours a day to see how it feels. Exercise will not make obese people thin. Exercise burns very few calories. A person can run for 60 minutes and then eat a snack with the same amount of calories

in only one minute. To make matters worse people are told they need to eat more carbohydrates for energy. This is another big lie. Carbohydrates are not needed for energy. The scientific minimum requirement for carbohydrates per day is ZERO.

MYTH # 16: RUNNING AND BICYCLING ARE HEALTHY EXERCISES

Don't believe this myth. Running is not a healthy way to exercise for many reasons. Destruction of the knees, ankles and feet by running has been solidly proven. The typical runner will develop knee problems within 20 years at best and within months for some individuals. Female runners are especially prone to health damage. Women in their late teens or twenties are seen running along highways and in parks. The first noticeable health damage is to the hormone system. Many women who run find a complete cessation of their menstrual cycle. They also become temporarily infertile or if pregnant have a miscarriage as a result of hormonal imbalance. Young women with babies can be seen running behind the special baby strollers near highway traffic. They place their baby and themselves at great risk. Frankly, this is pure nonsense. Women should not be doing this sort of exercise. What are they thinking? Do they seriously believe that running will prevent heart disease when they are 60 or 70 years of age? The answer is no. Running will be discontinued long before 50 years of age because of damage done to the body.

MYTH # 17: LIFTING WEIGHTS WILL MAKE WOMEN BULKY

False. Most women's bodies do not produce nearly enough testosterone to become 'bulky' like those body builders on TV," Tyne says. If you do find yourself getting bigger than you would like, simply use less weight and more repetitions.

MYTH # 18: EATING LATE AT NIGHT WILL MAKE YOU GAIN WEIGHT

False. "There are no 'magic' hours," Bender says. "We associate late-night eating with weight gain because we usually consume more calories at night. We do this because we usually deprive our bodies of adequate calories the first half of the day. Start the day out with breakfast and eat every 3-4 hours. Keep lunch the same size as dinner, and you will be less likely to over-indulge at night, yet you can enjoy a small late-night snack without the fear of it sticking to your middle."

MYTH # 19: NO PAIN NO GAIN

The burning pain that you feel when you exercise is lactic acid build up which actually stops you from continuing on in your workout. This "burn" has no proven physiological benefits. More importantly, a beginner may have trouble distinguishing simple lactic acid build up from a strain or sprain and may further injure themselves.

MYTH # 20: BEING OVERWEIGHT IS BAD FOR YOUR HEALTH

Your weight may be higher than average because you have more muscle, not necessarily because you're fat. If you're a few pounds over what the weight charts say you should be, calculate your Body Mass Index instead of relying on an outmoded weight chart. You can't rely on a chart to indicate your health: consider your aerobic capacity, your strength and endurance, and the way you feel.

DOESN'T KARATE-DO GENERATE AGGRESSIVE PEOPLE

As with anything in life, it depends on who is learning and how he is learning. It is possible to say that in Wado schools the teachers strive to avoid teaching people who have a violent tendency and training methods tend to root out people who are hiding their real intentions. There are actually many karate styles that do create aggressive, impulsive and dangerous people, but this can be traced to the fact that they have been guided by people of a low level of education or people that themselves were misguided by so-called "masters". It can also be traced to groups that are too competition oriented and in sports you must be aggressive to "win".

Why does Wado Ryu not create aggressive people? This could be due to the fact that the training objectives are never external (for example: "to win" or "beat" the opponent), rather they are internal: to search for self-excellence, to conquer and surmount your weaknesses, become a better human being, all other things can be judged secondary and even superficial if this is taken into consideration.

Aggressiveness is born out of power acquired easily, without sacrifices, these elements united with a weak mind and a weak morality, education and ethical background, are one of the possible sources of aggression and violence. This could be the case of a person that buys a weapon, he suddenly has the power to take a life, in a second he is "strong" and "powerful", without any sacrifices, no discipline, thus he abuses his "instantaneous power", he is aggressive, abusive and inhuman.

On the other hand, after 5 or 10 years of traditional Karate-do training, you have the ability of maiming or even killing an individual with your bare hands or feet, but in those years of intensive training your mind has changed, you are disciplined, you have learnt about yourself and other people, the value of life, the beauty of life, you now control your impulses and have overcome your weaknesses, you have obtained a very strong discipline mind. Even though you may have the power you do not use it, actually you shun violence and go great lengths to avoid conflicts and dangerous situations that could expose you to violence, you conceal your knowledge and never, never ever abuse of your capabilities. This is power (technique) with discipline (disciplined mind).