

MIND YOUR HEART

by: Dr. Roland A. Carlstedt, ABSP



Introduction

If you read my “8 Greatest Myths of Tennis Psychology” you probably noticed that I am quite skeptical when it comes to many of the concepts, claims and assumptions in Sport Psychology. The following from a peer-reviewed article of mine (Carlstedt, 1998) gets to heart of why I am often skeptical:

Unfortunately, most concepts and interventions in sport and performance psychology have not been sufficiently researched especially at the intra-individual level and temporally. Essentially, little is known about the underlying psychophysiology these theories allude to or bodily changes mental training methods supposedly induce. Taylor’s (1996) view of intensity (reactivity/activation) which he refers to as

the most critical factor prior to competitive performance because, no matter how confident, motivated, or technically or physically prepared athletes are to perform, they will simply not be able to perform their best if their bodies are not at an optimal level of intensity, accompanied by the requisite physiological and psychological changes... (p.75)

illustrates the imprecise manner in which physiology and interventions in sport and performance psychology are often discussed. In analyzing Taylor’s perspective on intensity, one still must ask, what do “confident ” and “motivated ” mean? Also, what is an “optimal level of intensity,” and what are “requisite physiological” and psychological changes” that accompany intensity? Similarly, how do sport psychology practitioners know they are really entraining “heightened attention” or manipulating reactivity (intensity) when using biofeedback since these psychophysiological states have yet to be adequately delineated or operationalized during real sport competition or unequivocally associated with potent outcome measures (i.e., dependent or criterion variables). Without studying the components and effects of physiological and psychophysiological processes on “real life” performance assumptions about intensity or states of activation and the effects of interventions on athletes remain speculative.

It’s not that most concepts and assumptions in Sport Psychology and methods used in attempts to enhance psychological performance are dubious, it’s just that when you decide to believe a concept at face value, entrust yourself to a method or anyone claiming to have “the solution,” you need to demand a minimum degree of proof or validation a particular mental training technique has a positive effect. I stress positive effect because even some of your better known interventions can actually affect an athlete’s

performance adversely, including imagery, depending upon whether certain personality trait constellations are present.

In my last article I also touched upon the “Ideal Performance State” or “Zone of Optimum Functioning,” a state or zone that certainly exists but rarely, if ever, is documented, especially during actual critical moments that are often encountered in tennis matches. In theory, mental training is usually designed to bring you closer to the “**Zone**” or “Ideal state. However, without knowing the psychophysiological parameters of YOUR “Ideal” state, the “Zone” will always be elusive, a hit or miss “feeling” most athletes have probably experienced, but are hard pressed to replicate let alone manipulate. Wouldn’t it be nice if you could reproduce this state at whim?

That brings me to heart activity, the physiological system that best illuminates the mind-body interaction and the ZONE. In my initial article I introduced the concept of heart rate deceleration, a heart activity parameter that can be seen as a window to the subconscious, as well as validated measure of intensity, attention/inattention, cognitive processing (thinking) and even the imagery process. Heart rate deceleration reflects much more than the cliché’ notion of “getting your heart rate down,” that is, just reducing your pulse rate. Heart rate deceleration is a phenomenon that was discovered decades ago. It is a psychophysiological response associated with heightened attention to a salient stimulus (a meaningful stimulus...like the impending serve when you are returning), a response occurring both at high and low resting heart rates. It is also associated with faster reaction times and reflects brain-heart interactions. Although usually unconsciously mediated (subconsciously), this psychophysiological response can be consciously manipulated; so the motto is: **MIND YOUR HEART**...and you may indeed be able to get into the ZONE

on purpose.

Obviously, doing so is easier said than done. Nevertheless there are Sport Psychologists and practitioners including myself who have conducted research on psychologically mediated heart rate deceleration, who are capable of **MINDING YOUR HEART**, that is, they can assess, monitor and help you manipulate brain-heart or mind body interactions to enhance performance. Doing this is a significant leap forward, a jump well beyond most of what is occurring in most of Sport Psychology today where simplistic and unscientific approaches are pervasive. Documenting heart rate variability parameters is one and perhaps the only means currently available that can make an athlete's psychological performance more transparent (visible). Heart activity is also the most reliable measure for validating the effects of mental training. Validating what mental training methods are supposed to do is crucial to the credibility of Sport Psychology.

Before getting to my specific mental training protocol, a routine based on peer-reviewed research and practice that I have engaged in over the last 7 years let's look at the brain-heart interaction more closely, along with the first study to document psychologically induced heart rate deceleration during official athletic match competition. The next section, although a bit technical will help you understand the unique characteristics of heart activity in relation to psychological performance during competition. I encourage you read through this and go beyond the superficial and cliches' in sport psychology, and become more advanced in learning about the mental game. When all is said and done I'll let you know how you can be assessed and taught to use heart biofeedback to improve your mental performance and how coaches and

and practitioners can obtain education and training in these methods.

Background: Heart Activity, An Ideal Measure of Psychological Performance

In addition to reflecting emotions and other psychological states (e.g., motivation), heart activity has also been found to be an important measure of attention and cognitive activity. Sandman, Walker & Berka, (1982) concluded that heart activity and blood pressure (BP) were the physiological parameters that best differentiated the cognitive-perceptual process (thoughts and perception). Not surprisingly, attention and cognitive activity play central roles in the anecdotal literature and research of sports performance (Gallwey, 1974; Waller, 1988). As might be expected, attention (e.g., focusing on the ball) is considered a desirable psychological state, whereas cognitive activity (e.g., thinking about winning during a point) is thought to disrupt sport performance. Gallwey (1974), in his classic work *The Inner Game of Tennis*, advocated letting things flow, or happen naturally, by focusing on the ball (attention), and warned of thinking too much about the consequences of hitting the ball. These notions appear to have found acceptance, with Ravizza (1977) reporting that 95% of the athletes he surveyed believed that thinking hinders performance. In addition Waller (1988) reported that reduced levels of cognitive activity (thinking) were experienced by athletes during peak performance episodes. Since, heart activity (i.e., HRV and HRD/HRA) has been shown to reflect many psychological states (e.g., attention and cognition), its importance to the investigation and manipulation of performance should be emphasized. It is an ideal measure for operationalizing (defining) psychological and behavioral concepts that have yet to be delineated beyond speculation including attention, cognitive activity and intensity.

Heart activity is also one of the few physiological measures that can be obtained relative easily during tennis competition. Without this capability, the study of heart-performance relationships would remain in the realm of the laboratory as is usually the case when using other physiological measures such as EEG (brain waves). Since, heart activity also reflects many of the psychological processes that are primarily associated with other physiological and behavioral measures including brain activity and attention/concentration, it can be substituted for EEG, to provide a window to the mind. Brain wave monitoring is virtually impossible during an action sport like tennis.

Performance Studies of HRD

In a letter regarding my “8 Myths” article one reader in a simplistic manner criticized the fact that the study I am presenting (below) only involved one person, questioning how one could reach conclusions on the basis of data from only one tennis player. My reply was that in the realm of psychophysiology, single-case studies are preferred and the norm, since all individuals vary in how they respond. An intense single-case study also affords much better control over so-called extraneous and confounding variables that can call a studies’ data into question. As previously mentioned, parameters of an athlete’s “Zone of Optimum Functioning” only has meaning in the context of a specific individual. Average measures based on many athletes only have minimum relevance and validity for a specific athlete. However, a phenomenon such as heart rate deceleration can nevertheless be a species-wide response, that is, a response every person exhibits to varying degrees. This can be concluded about heart rate deceleration because scores of research from the laboratory and in the field clearly identified this phenomenon as a species-wide response to a significant impending

stimulus. O.K., you ask, if everyone exhibits this response how does it distinguish one person from the next, and importantly how is it relevant to performance? These would be good questions, questions that I asked in formulating my study, since I wanted to see if this species-wide response associated with intensity, concentration, and thought processes, indeed varied as a function of performance or influenced performance. The following was written in my Master's thesis, where I also provide references to research on heart rate deceleration in sport:

The mere fact that HRD has been empirically validated as a species-wide response is of minor importance to tennis, if HRD cannot be linked to within-or between-subject differences in performance. Thus, if HRD does not distinguish good from poor performance why should it be studied? This question is in part answered by performance studies of HRD, which suggest that within- and between-subject differences in HRD are associated with differential task performance and level of skill.

Performance studies in sports have demonstrated HRD and performance interrelationships. These studies are particularly relevant to tennis because they have extended suggestive laboratory evidence to self-paced sports (e.g., golf and archery). For example, Wang & Landers (unavailable unpublished manuscript, as cited in Boutcher & Zinsser, 1990) comparing highly and moderately skilled archers, reported HRD in both subject groups prior to shooting (i.e., in the preparation phase before arrow release). In addition, they found phasic differences in heart activity between groups. For example, although both groups exhibited HRD patterns, highly skilled archers demonstrated significantly greater HRD in comparison to lesser skilled archers, during the aiming phase. In a similar study, of golf, Boutcher & Zinsser (1990) replicated the basic findings of Wang & Landers. In a comparison of elite and beginning golfers during putting, they also reported individual differences in HRD-performance effects. Specifically, they showed that both elite and beginning golfers exhibited significant HRD compared to baseline HR, prior to putting. In addition, elite golfers were found to experience significantly slower HR immediately before, during, and after the ball was putted, than beginning golfers.

In a more mechanistic study, Hatfield, et al. (1984) also reported that elite rifle shooters exhibited HRD prior to shooting. Although this study did not differentiate performance proficiency, it did provide evidence in support of previous electrophysiological and neurocardiologic explanations of psychologically mediated HRV (e.g., Lacey & Lacey, 1978; McCraty & Watkins, 1996; Sandman et al. 1982). For example, it was found that increased right hemispheric EEG activity was a concomitant of HRD prior to shooting. This finding was in line with previous research associating HRD with increased cortical activity (as observed in increased EEG activity; Lacey & Lacey, 1978; Sandman et al. 1982). The authors proposed that elite marksmen have developed attentional focus to the extent that they are unconsciously capable of reducing cognitive activity in the left hemisphere (i.e., left half of the brain). Left hemisphere cognitive activity has been associated with the disruption of motor performance (Hatfield et al., 1984; Langer & Imber, 1979).

The above studies are important because they clearly establish that the magnitude of HRD during self-paced sports is associated with a performer's level of skill. They provide evidence that HRD is not only a species-wide physiological response, but that it also reflects individual differences in athletic ability.

However, these studies did not investigate within-subject differences in HRD as a function of performance during actual competition and in relationship to outcome (i.e., performance proficiency [e.g., putting score over the course of an actual round of golf]), something this study will address.

One of the best ways to test whether heart rate deceleration is associated with better performance brings us back to the single-case study in which a tennis

player is monitored over the course of a few matches, with matches having extreme differences in outcome used to compare heart activity. If heart activity in a match that was won 6-4, 6-2, turns out to be significantly different than in a match that was lost 6-0, 6-1, and previous research has associated heart rate deceleration with faster reaction times and better performance, then differences in heart rate deceleration across winning versus losing matches become quite meaningful and are consistent with the research literature on this phenomenon. This was the case in a highly ranked Northern California junior boy who exhibited significantly more and greater magnitude heart rate deceleration in a match that was easily won compared to one in which he was blown away. Herewith, I will briefly present and describe my study:

Hypotheses

To test whether HRD patterns during tennis matches would resemble deceleration trends observed in previous research I used ambulatory heart monitoring equipment to measure a tennis player's heart activity over the course of two entire official tournament tennis matches (Match 1 and 3). I hypothesized that heart inter-beat-intervals (IBI = heart beats) would progressively lengthen (i.e., become slower) prior to action (when waiting to return serve). I also predicted that greater magnitude of HRD in pre-action phases of matches would occur with successful compared to unsuccessful performance (winning versus losing a match).

Results: Match Outcome

Match 1 was won by a score of 6-4, 6-1. Match 3 was lost 6-0, 6-1.

HRD Phases

There were 51 pre-action phases in Match 1 and 27 in Match 3. Pre-action

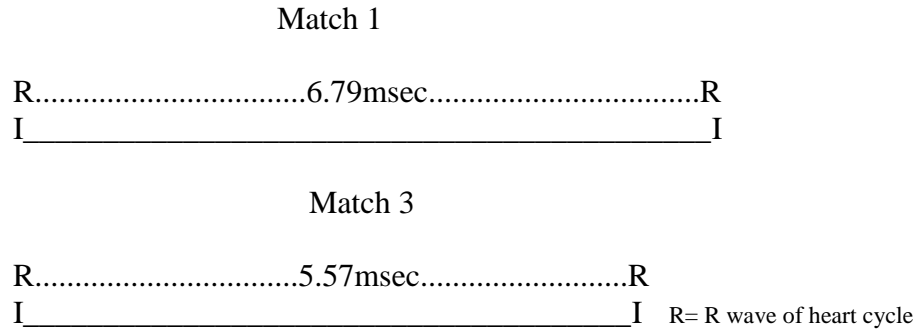


Figure 2. Mean rate of heart rate deceleration for all IBIs prior to action in Match 1 compared to Match 3 ($p = .045$).

2) The last IBI prior to action compared to the next to last IBI was significantly longer (slower) in Match 1 but not in Match 3.

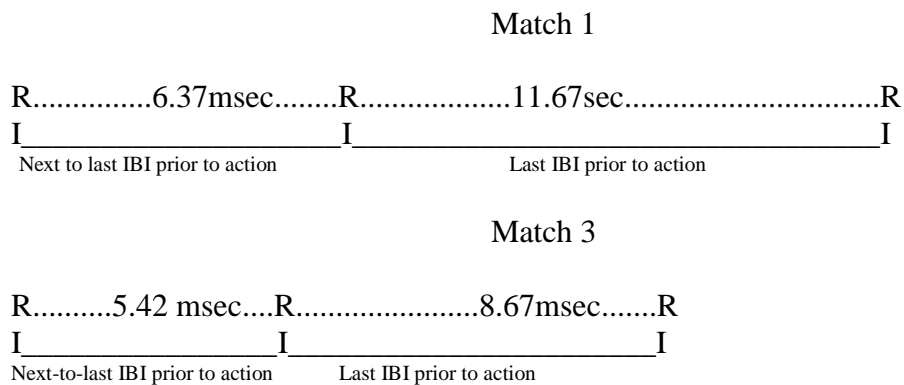


Figure 3. Mean difference in heart rate deceleration between the last IBI prior to action compared to the next-to-last IBI in Match 1 ($p < .008$) and mean difference of the rate of heart rate deceleration between the last IBI prior to action compared to the next-to-last IBI in match 3 ($p < .079$).

Discussion

The results showed that HRD preceded action phases during both tennis matches. More importantly, the general hypothesis of the study, which predicted more HRD prior to action phases in a match that was won compared to a match that was lost, was confirmed. Although both matches were marked by progressive HRD leading up to action, Match 1 showed significantly greater HRD in all configurations of IBIs prior to action. A particularly noteworthy finding was that the last IBI prior to action was

significantly longer compared to the preceding IBI (i.e., exhibited more HRD) in Match 1 than Match 3. This finding is consistent with studies by Lacey & Lacey (1978) and Jennings & Woods (1977), which reported the greatest amount of HRD in the last IBI prior to the presentation of a stimulus (e.g., the serve in tennis). These data also replicated studies reporting that successive IBIs, prior to the imperative stimulus, become progressively slower as the time of response nears (Jennings & Wood, 1977; Lacey & Lacey, 1978).

It should be noted that significant HRD occurred both within matches and between matches with this study also showing for the first time significant within-subject differences between HRD and performance and a longitudinal measure of outcome (matches on different days).

This study also marked the first time that HRD has been demonstrated at higher HR levels. In previous research, HRD was observed in the 70-90 beats per minute (bpm) range, whereas in this study, HRD occurred at levels as high as 150 bpm (Boutcher & Zinsser, 1990). This is noteworthy, as experiments of operant conditioning of HR ((McCanne & Sandman, 1976) have only attempted to slow HR below resting baseline or slightly elevated HR and has implications for biofeedback, suggesting that athletes can be conditioned to induce HRD even at high heart rates (important in basketball prior to the free throw or after a long rally in tennis). **It should also be noted, contrary to popular myth, despite greater HRD in the match that was won, greater overall heart rate was evident as well, supportive of the hypothesis that heart rate deceleration is more important to performance than slower overall heart rate per se.**

The results of my study become more meaningful when considering the

diametrically opposite performance and outcome of the two matches. These extreme differences are reflected in quantitative performance data (e.g., match score and statistics) and qualitative impressions of the match (i.e., psychological performance). In addition, the player's self-report indicated major differences in attention, emotions, self-confidence, cognitive activity, and intensity/nervousness between matches, feedback that was consistent with HRD trends and in line with theoretical and hypothetical explanations of what HRD is thought to reflect (increased attention and reduced cognitive activity, and nervousness).

The fact that performance and outcome between-matches were incongruous suggests that HRD is not only a species-wide physiological response to an impending stimulus, but that HRD also varies as a function of specific tasks, performance demands, and psychological factors and may be a global longitudinal (long-term) marker of differential states of attention, reactivity, and cognitive activity during real competition.

O.K....what does all this mean and how can I apply this knowledge to improving my game? I thought you'd ask that. First I'll summarize the findings in outline form. Then I'll discuss the findings in the context of the enhancement of psychological performance and the *Carlstedt Protocol*.

Summary of Findings

1. Greater heart rate deceleration was associated with vastly better performance.
2. It clearly distinguished a match that was won from one that was lost.
3. The heart rate deceleration exhibited in this study was consistent with previous research, but also showed for the first time that heart rate deceleration was associated with a meaningful outcome measure during a real tennis tournament match, namely winning or losing a match.

4. Baseline or overall heart rate reduction did not distinguish outcome, suggesting that it is not heart slowing or slower baseline heart rate per se that reflects better performance, rather heart rate deceleration within the context of any heart rate trend, whether high or low. That is, heart rate deceleration can occur during heart rate trends as high as 180 beats per minute or as low as, for example, 60 beats per minute and is more important for assessment purposes and mental training than just lowering one's heart rate arbitrarily outside the context of an impending competitive situation. Remember, heart rate slowing occurs naturally anyway once action ceases. Rarely will heart rate increase after action has stopped (e.g., after a point ends).

5. Differential heart rate deceleration appears to be a reliable psychophysiological correlate or marker of attention/concentration, perceptual processes, intensity, and reactivity (nervousness/stress).

What Do These Data Mean for Me?

I want anyone who has bothered to closely read this fairly technical article to keep the momentum going by researching the described heart phenomenon and making a serious effort to have their "Zone of Optimum" functioning using heart activity assessed. You have to put as much into improving your mental performance as you do with your physical and technical performance. Even if you have learned various mental training techniques such as imagery, progressive relaxation, self-talk, and various "psyching" methods you still need to know how or if they are affecting you psychophysiologicaly, and what influence they have, if any, on your actual tennis performance. Without such objective mind-body feedback you are leaving things to chance and as I pointed out in my "8 Myths" article, just because someone tells you to try something popular because everyone does it, does not mean it will work. Wouldn't you rather learn whether methods you are engaging in really work? Wouldn't you want to know if mental techniques you engage in result in heart activity parameters such as increased heart rate deceleration that facilitate performance when it counts? Wouldn't you like to be able to manipulate brain-heart interactions to increase attention and reaction times?

How Can I Manipulate Heart Activity to Improve Performance?

The Carlstedt Protocol

Here is a step-by-step look at how one goes about learning to control or manipulate heart activity and psychophysiology(heart rate deceleration and general heart rate variability):

1. Initially one is administered a battery of tests to assess tendencies in ability to use imagery, subconscious processes, and reactivity (stress response or nervousness) and brain hemispheric preference.

These tests provide insight into baseline psychological and behavioral processes and help predict how a person/athlete will respond in stress and competitive situations. The used tests are standard tests that have been psychometrically validated, meaning they are valid and reliable in measuring what they supposedly measure.

2. Thereafter, a psychophysiological stress test is administered in a office or lab. setting in which standard psychological stressors are introduced to a person/athlete. A person's psychophysiological responses to these stressors reflects their reactivity or stress reaction. The stress reaction is compared to tests taken that are relevant to this response. In a high percentage of cases the written self-report test(s) is consistent with the stress test and vice versa.

3. Next the person/athlete (in this case, tennis player) is placed in a competitive practice situation or actual match, wearing heart activity monitoring equipment (e.g., POLAR heart rate or Holter-like monitor). Heart activity is monitored for the course of an entire match or practice session. Heart rate deceleration trends are then isolated relative to important moments of competition and statistically analyzed in relation to performance parameters (e.g., HRD and winning returns; or HRD and service %, or HRD and match outcome). In addition, a spectrum analysis of the entire heart rate data set is routinely carried out. This analysis offers very reliable insight regarding a player's overall stress state during competition through a ratio measure of sympathetic to parasympathetic nervous system activity (the flight or stress/intensity response versus the relaxation response). This aspect of heart activity will be discussed more in-depth in a future article.

4. Once all data are analyzed we enter the biofeedback phase or the psychophysiological mind-body training phase.

5. Depending upon one's psychophysiological tendencies a player is taught to manipulate their heart activity and perhaps even other measures including EEG, skin-temperature, and/or muscle tension in the direction conducive to peak performance.

Biofeedback involves observing your physiological responses to stress or other variables a practitioner presents on a monitor. You are then asked to use mental strategies to manipulate the desired psychophysiological reaction or response in the desired direction, in this case, inducing heart rate deceleration. This is at first done in a lab. or office.

6. Once you have mastered this in a static or non-active setting you are moved onto the court and asked to do the same prior to a particular athletic task, say, when returning serve. Once you are capable of inducing a response associated with “good” performance (e.g., 1st serve in 75% of the time) you are ready to be monitored in a match.

7. You might notice that we are progressively introducing more stress. Obviously, the least stressful situation usually involves written tests, followed by lab and court tests, then biofeedback in the lab., biofeedback on the court, and then the actual match, where stress should be the greatest. In this final task you play a set or match while monitored. After the match your heart activity is analyzed for heart rate deceleration and overall heart rate variability.

8. If you have learned to manipulate heart activity and induce heart rate deceleration, this should be apparent in the heart activity data from the match. Although learning heart rate deceleration will not guarantee a victory, it will give you and your coach the assurance that you are not losing because of mental factors, since HRD reflects heightened attention and reduced anxiety prior to important or critical moments of competition.

Biofeedback works by helping you associate thoughts and feelings with physiological changes or responses. These responses can be beneficial to or hinder performance. Learning to distinguish these disparate states is facilitated through the monitor you constantly watch during the “entrainment” phase of biofeedback. Thereafter, you are weaned from the monitor, whereupon you should be capable of inducing ideal responding in a competitive situation.

9. Biofeedback refresher sessions should be engaged in whenever you or your coach feel necessary, for example, when you go into a slump or play a very bad match. Devices are available for very basic biofeedback check-ups and practice that you can use by yourself once you understand the principles behind this method of mental training.

How, Where, and When Can I Have my Heart Activity Monitored?

Sadly, the field of Sport Psychology as it operates today is generally ineffective in making readily available, opportunities to have one’s psychophysiological functioning assessed using reliable methods such as heart rate variability analysis. Most practitioners don’t even know about these possibilities, let alone have training in these promising methods. As a result they wouldn’t think of referring you to practitioners who can

carry out psychophysiological assessments and teach you biofeedback methods. Sorry if I'm offending practitioners here, but instead of getting mad now is the time to expand your scope of research knowledge and practice to include cutting-edge methods, or at least align yourself with practitioners who can augment the service you provide your clients (see: www.americanboardofsportpsychology.org, for training and certification in the latest research and methods in Sport Psychology).

Although there are many clinical practitioners who use psychophysiological assessment and biofeedback, few specialize in or are familiar with the unique demands of tennis and other sports. Knowledge of the game and the temporal (timeframe) relevance of heart rate deceleration/variability to performance and outcome is a must. Obviously, I recommend myself as being perhaps the only practitioner in Sport Psychology and tennis who has trained and performed peer-reviewed research in the methods described in this article, and am available on a private basis or in the context of seminars at tennis clubs, and with tennis teams, coaches and instructors. The idea behind the psychophysiological approach to the enhancement of mental performance is to document mind-body parameters during practice and competition, especially heart rate deceleration and overall heart rate variability. Once a player's general response tendencies have been assessed, heart activity biofeedback is used to teach them how to manipulate heart activity trends most associated with increased attention, reduced negative intrusive thoughts, and general nervousness. Over time a player is weaned off biofeedback monitors, once they have learned to manipulate mind-body interactions in the direction conducive to peak performance.

While psychophysiological assessment and biofeedback take time and discipline,

you really can't get around these techniques if you are serious about your mental game. However, once you learn more about your tendencies in psychophysiological responding you'll realize how valuable such information is and will look at psychological performance from a new and enlightened perspective. Here's what I am offering:

The Carlstedt Protocol for the Enhancement of Psychological Performance Seminars

Dr. Roland A. Carlstedt, is available to present his protocol to tennis clubs, teams, coaches, educators, schools, and businesses. The **Carlstedt Protocol** lends itself well to most sports, especially tennis, golf, basketball and baseball, and can also be used to enhance performance in business situations, the performing arts, and even medical settings as well.

This Protocol goes well beyond the speculative and hypothetical that marks most forms of mental training today by providing objective assessments and documentation of basic mind-body states and reliable methods for manipulating them in the direction conducive to peak performance and entering the ZONE.

The Carlstedt Protocol is not some simplistic quick-fix type of mental training, rather it is a reliable and validated method for inducing positive change having implications not only for sport and performance, but for one's quality of life. The Carlstedt Protocol requires time and practice initially, but once it has been internalized you will benefit the rest of your life and career, as an athlete and person.

If you are interested in a Carlstedt Protocol Performance Enhancement Presentation, Seminar, or Testing Session please contact: DrRCarlstedt@aol.com or call 917-680-3994 for more information.

Commissions are available for persons interested in promoting these seminars.

Coaches and Instructors are also **invited to integrate** the Carlstedt Protocol into their club, school, or tennis academy.

Training and Certification in this and other methods is available through the American Board of Sport Psychology (see www.americanboardofsportpsychology.org)

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