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Aerobic versus Anaerobic Training

The following is an excerpt from a book on training for ice hockey that I probably will never finish. I posted this in response to a beginner forum question on aerobic versus anaerobic training. I believe that you could substitute the name of any field or court sport for hockey and my opinion on training would not be greatly altered. Please feel free to read and post comments.

Any chapter on the concept of training for ice hockey must begin with the concept of conditioning. Why? Because there seems to be a level of controversy relative to conditioning theory that is not present in many of the other training methods. Most experts in the area of conditioning for ice hockey are in some level of agreement as to how to improve strength, speed or power. The area of disagreement is in the area of conditioning or more specifically in the evaluation of conditioning. As a result, the early portions of the chapter will focus on conditioning while the later parts will focus on strength, speed and power.

The Physiology Behind Ice Hockey- The NHL Theory

In some circles of the hockey world, particularly in upper management levels of the National Hockey League, there exists a flawed assumption that the overall fitness of a hockey player is based on his or her maximum oxygen consumption (Max. $\dot{V}O_2$) MVO₂, or maximum oxygen consumption, is a standard measure of aerobic capacity frequently utilized to evaluate the condition of athletes involved in endurance sports like distance running, cycling and rowing. This assessment has never been shown to correlate to performance in sports that are intermittent in nature like hockey or court sports.

In spite of this obvious disconnect, many National Hockey League teams still test for aerobic power (MVO₂) during training camp or in the early part of the season and base their assessment of a player's physical condition on this statistic. Many teams do this in spite of objection from the strength and conditioning coach they have hired to supervise the process of training their players. It is a widely held misconception among executives that is not shared by their key employees. Years ago I can remember one now unemployed NHL general manager boasting that he had the most fit team in the NHL based on an MVO₂ average of over 60 ml/kg/mm. The influence of exercise physiologists is heavily

felt in the NHL and, this information tends to trickle down. This trickle down creates a problem at the collegiate level and really at all levels of hockey.

Is Hockey an Aerobic Sport?

Any good strength and conditioning coach will tell you that hockey is a sport of speed and power. In fact hockey players obtain the highest level of speed in any team sport and as a result, also endure the hardest collisions. The bioenergetics of hockey are unlike any other sport in that players enter and leave the playing surface at regular intervals and engage in brief high intensity sprints. To assume that the development of an aerobic base is essential for this type of activity is foolish and shortsighted. In fact, performing conventional steady state training for aerobic capacity is potentially catastrophic, particularly for the smaller, younger and/or less explosive player.

If hockey is not an aerobic sport, why has aerobic capacity been emphasized for so many years? Many teams emphasize aerobic capacity for their players because exercise physiologists, hired in the nineteen eighties, postulated that an efficient aerobic system would promote faster recovery on the bench between shifts. This was an oversimplification based on the built in bias of eighties era exercise scientists. The real truth may be that physiologists simply did not have another easily administered test that measured a fitness component. This was the classic case of “when the only tool you have is a hammer, everything begins to look like a nail”. The logic seemed simple. Good hockey players did not seem to be aerobically fit. The simplistic solution was to improve this quantity. Another reason many teams may have emphasized aerobic training is that it is easy to perform and implement, particularly when compared to training for speed and power.

However, the questions really begin at this point. An efficient aerobic system may facilitate faster recovery. However, at what cost are we developing the aerobic system? Is the apparent lack of aerobic fitness in elite hockey players a positive or a negative adaptation? In 1990 I began to work with elite players at Boston University as well as with elite players from Boston College and Harvard University. One of my first observations was that these elite players performed poorly on all tests of endurance yet performed very well in tests of strength and power. If I had followed conventional wisdom I would have sought to work on the weaknesses of these athletes. Instead, I chose to view their strengths as their keys to success and instead focused most of my energy on further improving their strengths. I found support in the words of Canadian sprint coach Charlie Francis.

Francis notes that ‘young athletes who do not achieve high levels of oxygen uptake during a treadmill test but who perform well over 10 to 40 meter sprints probably have inherited a high proportion of white power related muscle fiber.’¹

In other words it would be “normal” for an elite athlete in a strength and power sport to have low aerobic power. In simple terms, an elite marathoner will not make a good sprinter. Simple logic?

¹ Training for Speed- Charlie Francis

Francis goes on to state “endurance work must be carefully limited to light - light/medium volumes to prevent the conversion of transitional or intermediate muscle fiber to red, endurance muscle fiber.”²

Physiological principles tell us that muscle fiber responds to training. Were we taking explosive anaerobic athletes and in our zeal to simply enhance their recovery ability making them in fact “slower”? Was the analysis of the exercise scientists wrong? Giraffes developed long necks in order to reach high leaves. What makes a great hockey player is speed and power, not aerobic capacity. The players had actually adapted well to their sport and in effect were naturally geared for it. These players excel because hockey is a highly anaerobic game that puts a tremendous stress on the non-aerobic energy systems.. Former New Jersey Devils head coach John Cuniff had estimated that the average NHL player gets seven shifts of approximately 45 seconds during a 20 minute period. Players are generally off the ice for two to three minutes. During these 45-second shifts, players are actually performing a series of three- to five-second sprints. Very rarely is a player actually skating hard for the entire shift. Assuming that a 20-minute period actually lasts for approximately 40 minutes due to stops in play for penalties etc. a player will do seven sprints over a 40-minute time frame and then have a complete rest for approximately 20 minutes. It would appear that the aerobic demand of the previously described sequence would be fairly low. However, the demands on the athletes speed, speed endurance, and acceleration would be high. For most players an excessive emphasis on aerobic training would in fact be counterproductive. This is especially true for a young developing hockey player.

The following chart was compiled by statisticians in the 2002 World Championship Final

Player	Shifts	IceTime	PT	PR	PA	SA	Touch
Sakic,J	27	15:25	1:19	21	21	7	44
Modano	28	19:47	:58	17	22	4	44
Amonte	22	12:51	:46	11	4	5	33
Key							
PT	Possession time						
PR	Passes received						
PA	Pass attempts						
SA	Shots attempted						
Touch	Puck touches						
Game notes							
Canada wins Gold, USA takes silver. Sakic has 2 goals and two assists and was MVP. Amonte had 1 goal on 3 shots on net, Modano had 1 assist.							

Look at the ice times of the worlds best. Sakic averaged 34 seconds per shift. Amonte’s average shift was thirty two seconds. Modano’s were slightly longer. This was some of the most intense hockey in history. An average of one minute of possession in a sixty minute game? An average of about five minutes of ice time per period? Ice time averaged out to approximately sixteen minutes for the

entire game and the average number of shifts was 25. Amazingly the late Coach Cuniff's estimates were surprisingly accurate. Coach Cuniff had estimated twenty one shifts and about fifteen minutes of play.

Are Aerobic Adaptations Even Desirable?

One of the major drawbacks of conventional aerobic training is that the long slow distance methods most often used to develop aerobic capacity may compromise speed at the cellular level. In fact the adaptation of the muscular system to aerobic training is in direct opposition to the primary needs of the hockey player as indicated by the data in the chart.

In effect, some players may be "training themselves out of the league" by adhering to the aerobically oriented off-season programs of many NHL teams. A larger, highly skilled player may not be as adversely affected as a marginal one in the NHL. Marginal players generally have lower vertical jumps and anaerobic power scores (based on the Wingate 30 second sprint test) than their more highly skilled counterparts. This indicates that these players are already at a disadvantage that will only be magnified by an aerobically oriented training program. In a simplified view, muscles are made up of three types of fibers; fast twitch (anaerobic), slow twitch (aerobic) and intermediate. The ratio of fast twitch fibers to slow is one of the primary determinants of success.

Current theory leads coaches to assume that athletes with low MAX V02 values are 'out of shape'. In fact, these athletes probably possess the exact quantity that coaches are looking for. At Boston University, a perennial NCAA power, , most of our talented players were the worst in aerobic capacity. An athlete with a high vertical jump and poor aerobic capacity is in fact a better prospect than one with great aerobic capacity and poor explosive power. I am found of the saying "it takes years to develop speed and power but only weeks to get in shape". Athletes with predominantly fast twitch fibers will excel in sprint-oriented sports such as hockey but will struggle in aerobic activities. Those with predominantly slow twitch fibers will excel at endurance oriented sports. Most educated readers would not be amazed at this information. However, what happens to the intermediate fibers is a result of the training program followed. A program emphasizing long aerobic workouts will cause the intermediate fibers to adapt the characteristics of slow twitch fibers. A program emphasizing interval sprints from five to 60 seconds, with longer recovery, will promote the movement of intermediate fibers toward the anaerobic, fast twitch fiber.

Anaerobic Training to Develop the Aerobic System?

Conventional aerobic training (long slow distance) should never be done for ice hockey players unless it is infrequently used for recovery purposes. Instead, the aerobic system should be developed as a byproduct of anaerobic training. Interval training, (anaerobic intervals) will generally keep the recovery heart rate in the aerobic range (over 120 BPM) if the rest periods are controlled properly. Interval training will develop aerobic capacity but as a byproduct of the anaerobic work. This is obviously a more sport specific method of training the aerobic capabilities of an anaerobic athlete.

What Really Matters?

A hockey player's conditioning level should be determined by a battery of

tests, not by a MAX VO₂ test. MVO₂ tells a coach that a player has an efficient aerobic system. So what?

A VO₂ test does not in any way predict on-ice or off-ice performance.

There is no data to support the use of VO₂ testing for hockey players. In fact the data drawn from our collegiate players showed no correlations between VO₂ scores and performance on any other competitive test.

A high VO₂ in a young player may indicate that the player is not suited to an intermittent sport like ice hockey. If a young player has a high VO₂ think twice before you recruit or draft him.

For nearly twenty years I have advocated that coaches and scouts look instead at vertical jump scores to select players. The bottom line- a high VO₂ indicates a higher percentage of slow twitch muscle fiber. Exactly what you don't want. A high vertical jump indicates a high percentage of fast twitch muscle fiber, exactly what you do want.

Georges Laraque or Daniel Tkaczuk?

I can remember a conversation with members of the Boston Bruins management and scouting staff in 1995 in which I advocated drafting a player named Georges Laraque. Prior to the draft the scouts provided me with test data from NHL Central Scouting Combine to review. I looked at weight and vertical jump to see who was the most explosive athlete in the draft. I was almost laughed out of the room. When they asked me why I would recommend Laraque, a player I had never seen play, I gave them a simple answer. Georges Laraque was in the wrong draft. This provoked confused looks from the Bruins staffers present. I told them George Laraque was supposed to be in the NFL Draft. Physically, Laraque jumped off the testing pages at me. A huge eighteen year old with incredible explosive power. If my memory serves me, Laraque was about 225 lbs. and had a thirty inch vertical jump at 18. A tremendous physical specimen. As we know Laraque became one of the most feared men in the NHL. The converse was true with Daniel Tkaczuk, the Calgary Flames first pick (6th overall) in 1997. Tkaczuk has been a career minor leaguer, never establishing himself as an NHL player. Tkaczuk he had a 19 inch vertical jump at age 18. I cautioned scouts at that point that Tkaczuk might never skate well enough to play in the NHL due to his extremely low explosive power. In reality, I would not draft a young goalie with a 19 inch vertical jump much less take a chance on an undersized player with such low power.

The true way to evaluate players would with an equation called the Lewis Power Formula. The Lewis Formula takes bodyweight into account and relates the vertical jump to bodyweight. Had Tkaczuk been a larger player (over 225 lbs.) his low vertical jump would have been less cause for alarm but, at 185 the low

power output should be a huge red flag. While working for the Boston Bruins from 1991-1999 it became apparent that the vertical jumps could be lower if the player was larger or very highly skilled. I found that I could almost divide our training camp roster into NHL players and AHL players just by looking at power outputs. Very few players made the Boston Bruins during that time period who did not have vertical jumps in excess of 25 inches. The exceptions were heavier defensemen (215- 225 lbs.) and even those players tended to be 23-24 inches.

If I were to evaluate data today, I suspect the numbers would even be higher. The bottom line, vertical jump is a much better predictor of performance than VO2.

Fit for Hockey?

I know the next big question. How do I know if a guy is in shape? The answer, test them. Don't take a physiological measurement, test them. My friend Paul Robbins, an exercise testing expert, is fond of saying VO2 is a measure of what a player *might* do. In other words, VO2 indicates a high *capability* to produce energy aerobically. Even if we thought aerobic capacity was important (I do not) we still are in the "might" category if we test VO2.

Former Boston University and current Pittsburgh Penguins defenseman Ryan Whitney is one of the fittest athletes I have ever coached. In any performance related test (2 mile run, 300 Shuttle Run, 10/10 Treadmill test) we have ever done Whitney has never placed out of the top three. However by conventional testing standards Whitney is out of shape. Whitney has never posted an unusually high VO2 score. In fact at the beginning of the summer program in 2006 Whitney scored a 41 on a bike VO2 test. Normally he tests average, middle of the pack. Why the discrepancy? Because the VO2 test measures physiology not performance. What matters is performance. If I line two guys up for a race, who will win? A performance based method makes physiology only part of the equation. Performance testing adds in the intangibles like heart and grit. I can't tell you how many NHL players have complained about being accused of being unfit and always had the same response. " So and so rode the bike half as long as I did and got a better score".

The 10/10 Test

This is my favorite conditioning test for hockey players as it tests conditioning and mental toughness. The problem is that the relatively high treadmill speed makes the test somewhat dangerous. Be careful. This test is not for athletes who have not done interval training on a treadmill.

To perform the test have the athlete begin running at 10 MPH and 10 % incline and run to exhaustion. Again be careful. The test terminates rapidly and athletes

not familiar with treadmill running can potentially fall. Test scores will range from one minute (deconditioned) to three minutes (extremely rare)

Examples

Female Record- Tricia Dunn 3 time US Olympian in Women's Ice Hockey
1:45

Male Record - Kirk Miller Boston University Soccer
3:15

Hockey Record- Brian Collins BU
3:00

Another similar test uses 7 MPH and begins with a 2% incline. The treadmill grade is raised 2% every minute until 10% after 10% the incline is raised one degree at a time. This test is safer as the speeds are slower. I first was exposed to this test via Strength Coach Ray Bear of the Atlanta Thrashers.

BU Record- 13% Incline (8 minutes)

The test also included a VO2 relationship chart although this is suspect at best.

10% = 52 VO2

11% = 54

12% = 56

13% = 58

**We have found huge discrepancies in estimated VO2 readings from test like this so we never use estimated figures.*

The NHL's fascination with the VO2 Max reminds me of Billy Beane's quote in Moneyball "We're not selling jeans. Don't get me guys who look like baseball players, get me guys who can play baseball"

The NHL is trying to find sprinters by running a marathon. Don't get a great bike rider, get me great competitor.

Sub max Failings

Even more idiotic are the teams that try to save money by using estimated submax tests. In estimated tests, no gas analysis is used and scores are estimated based on formulas. This takes a questionable concept like VO2 testing and brings it to the level of absurd. The bottom line is that only 30% of players will fit the formula. That means that seventy percent of the scores are wrong. Some are higher than actual, some lower. At least VO2 tests with gas analysis have some level of accuracy even if the data is useless. How can this be true? Only thirty percent of the population fits the 220-age formula for determining

maximum heartrate. The older the player, the less likely the test will be valid. Older players will not have the same decrease in max heartrate that is statistically predicted by the formula.

What can you get from VO2 testing?

So is a VO2 test useless? No, it's just useless for determining who is in the best shape. The key is that there are better ways to determine conditioning level for intermittent sports. However, what the better VO2 testing units on the market will do is give us an indication of anaerobic/lactate/ ventilatory threshold and an actual maximum heartrate. The entire concept of lactate as a factor in fatigue is very much in flux as this is written. Many top physiologists are unsure if what we see at threshold is actually the onset of anaerobic metabolism. In any case we do know that a ventilatory threshold occurs and that this threshold signals some type of metabolic change.

The key seems to be not a high VO2 max but rather a high threshold. This is a measure of efficiency. The question is not how much aerobic capability but rather how much useable aerobic capability.

220- Age?

Where did this come from? The 220 minus your age formula is one of the urban legends of exercise science. Even the ACSM, in it's own manual, makes reference to the fact that at best only thirty percent of the population fits the formula. More importantly, this means 70% don't fit the formula. Even more important, 30% are two standard deviations outside of the formula.

Another important point, particularly as it relates to professional hockey, is that older athletes seem to be less inclined to fit the formula. Itg is not unusual to see 35 year old hockey player work in excess of 185 beats per minute. The point is that these "assumptions" can create significant program design issues if used to create training programs.

Hockey Conditioning Case Study

Player 1

27 yrs old
5 Year NHL Veteran
5'10" 202 lbs.

Peak VO2 51.5
Peak HR 172
AT VO2 48.4
AT HR 165
% Efficiency 93%
1 min recovery 50 BPM

Player 2

28 yrs. old
8 Year Vet
5'10' 190 Lbs.

Peak VO2	53.1
Peak HR	181
AT VO2	41.5
AT HR	163
% Efficiency	77%
1 min recovery	25 BPM

Efficiency is calculated by dividing the peak number by the AT number. One minute recovery is the drop from the highest heartrate over the first sixty seconds.

This is a classic illustration of why VO2 stats can be misleading. Player 1 is obviously significantly more fit than Player 2 even though Player 2 has a higher Peak VO2.

How About Recovery?

The real key to fitness in any intermittent sport may not lie in the performance but rather in the recovery. It is now becoming more common to measure recovery heartrates at the one minute and two minute mark of the recovery period. In my estimation, the fittest athlete may be the athlete with the most rapid recovery. My athletes range from 30 to 50 beats of recovery over the first minute. My feeling is that the “fittest” athlete is probably the one who recovers most rapidly.

Run or Bike?

The next question is whether a hockey player should run or bike. Many teams have been strong advocates of the bike for hockey players. I personally think this is a huge mistake. The off-season use of the bike is a reflection of the in-season training done by many teams. Most teams have exercise bike programs for the players to follow in-season on off days or post game for recovery or additional conditioning for those who play limited minutes. This is an excellent idea.

Hockey players *should* use a stationary bike in-season as the bike spares the groin muscles. For the same reason hockey players *should not* use a bike in the off-season. In the off-season hockey players are trying to condition the groin muscles for injury prevention. Stationary bike work uses an incomplete range of motion and is effectively a passive recovery of the hip (the push down of the opposite leg causes the hip to flex but, it is not an active motion). Stationary bike effectively prevents the groin muscles from being worked in the off-season. For hockey players a combination of tempo running, interval running (shuttle style, not track based) and slideboard work will work the groin muscles in the off-season.

What Makes a Successful Player?

Success is most dependent on hockey skill. However, if the quality of skill is assumed, the next most valuable quantity would have to be speed. The training of a hockey player frequently resembles the training of an endurance athlete.

However, the training program should probably resemble that of a sprinter. The emphasis should be on developing the power of the legs and hips through lower body weight training, plyometrics, and sprinting and developing conditioning through a work capacity based interval training model.

Work Capacity Based Interval Training- Specific Conditioning for Development of Energy Systems

The frightening fact is that Vern Gambetta advocated abandoning the conventional aerobic base theory nearly twenty years ago. Gambetta instead advocated developing what he simply called work capacity. Work capacity loosely defined was the ability to play the game. It didn't really matter what game. Gambetta, in seminars that were at that time called **Building the Complete Athlete**, advocated an approach that was based on nothing more than common sense. Vern's advice, watch the game. See what happens. Train in a manner that will enhance performance. I have taken to calling this process Building the Base by Inverting the Pyramid.

I have spent more than twenty five years attempting to figure out the best way to get in shape for sports. It has become almost an obsession. Along the way I have been forced to study physiology and argue with physiologists. I have come to a simple conclusion.

Want to become a great violinist? Practice the violin.³

The quote actually came from Ajan and Boraga's book on Olympic weightlifting and was intended for Olympic weightlifters. I have found it to be much more far reaching.

In my opinion, exercise physiologists have no idea what they are taking about when it comes to evaluating conditioning for sports or training to develop conditioning. If you have read this far, this is obvious. The conventional approach is backward and misses key variables.

The conventional model of training espouses the development of conditioning in a pyramidal concept. Many so-called experts in the fields of training and

³ Ajan and Boraga

coaching have continually postulated that the peak of conditioning could only be as high as the base allowed. The base in theory was the development of a level of aerobic capacity onto which a series of anaerobic blocks could be placed. This was a mechanical or architectural model based on a mechanical system that probably does not apply to exercise. Interestingly enough, coaches have for years rejected this model as unworkable yet, physiologists continue to spread what I call have come to call “the myth of the aerobic base”. In all of my programming and writings since the early eighties I have indicated that the concept of aerobic base was flawed and the development of an aerobic base is in fact counterproductive. Numerous studies have proven exactly this over the past ten years yet we still continue to have exercise scientists advocating a period of general aerobic training to “develop the aerobic base”.

What I would propose is an inverted pyramid based on a work capacity model. If our goal is to be able to go at a hard pace for 30 seconds, the model that makes sense is pictured below. Although times could be changed (to 45 sec or 60 sec.) the concept would not change. It is far better to start small and develop conditioning than to endure the potential overuse injuries and potential negative fiber type adaptations associated with endurance type training.

Work Capacity Based Model for Energy System Development

	Number of Reps						Total Time
Week 1 - 3			30 sec	30 sec	30 sec		1:30
Week 2- 4			30 sec	30 sec	30 sec	30 sec	2:00
Week 3 - 5			30 sec	30 sec	30 sec	30 sec	2:30
Week 4 - 6	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	3:00

Specific Conditioning Recommendations

By this point it is obvious that the majority of conditioning for ice hockey should be interval training done on a football or soccer field, or on a slideboard or bike. As stated previously, conditioning effectiveness is drastically increased if a heart rate monitor is used. Don't bother with the expensive models unless you are computer literate. A simple monitor will do a great job. Although the bike is the preferred method for many in the NHL, the track and slideboard are superior. Many athletes avoid running due to “knee problems”. However, most knee pain is caused by distance running, not interval training. Interval sprints are usually tougher on the muscles and mind than the joints. Here are some simple recommendations:

1- Tempo Runs.

Begin an off season running program with tempo runs. I like to run 110 yards (the length of a football field from the end line to the opposite goal line) and simply

walk the width of the field. When you reach the opposite sideline, run 110 yards back. In tempo runs you should run at 75-80% of your pace you would use if you sprinted 110 yards. This 75-80 % pace would be about 18-20 seconds for 100 yards. Over a three week base phase we would begin at ten times 110 and work up to 14. Tempo runs get the body ready for the more aggressive intervals to follow. Remember running is essential in the off-season to counteract the negative postural changes of a full season spent bent over and forward flexed in the skating position. Stationary cycling on the other hand reinforces the negative changes of the hockey season by keeping the body in a flexed posture and not allowing the hips to extend.

2-Shuttle Intervals

The next step in the off-season conditioning program is to progress to shuttle runs. The fundamental difference between tempo runs and shuttle runs is that shuttle runs begin to increase the muscular effect. Shuttle runs involve three key injury prevention features, acceleration, deceleration and direction change. One of the failures of track based interval programs (440's, 220's etc) is that the program does not incorporate two of these three key injury prevention features. Injuries are most often associated with the muscular stresses caused by speeding up, slowing down or changing direction. Shuttle runs add a muscular component to the energy system program. Begin with:

- 150 yds at 25-30 seconds followed by a 60 second rest.

This can be done on either a 25 yd or 50 yd course. A 25 yard course is more difficult as it doubles the amount of direction change and resulting acceleration and deceleration.

- Progress to 300 yards done in less than 60 seconds

Bike Training

Interval training on the bike can be effective for older players who are unable to run due to wear and tear. I find my younger players tolerate running well while older players bodies are less conducive to running. Running will always be the preferred method but, the bike can be an adequate substitute.

We tend to ride for twice the time interval as running. In other words if the workout called for 6 x150 yds (approx 6x:30 sec), we would substitute a bike program of 6 times one minute. In our case, we use Schwinn AirDynes to capitalize on the dual action of upper and lower body and actually ride half miles.

Slideboard Training

The Slide Board as a training tool was made popular by Olympic speedskater and current USA Hockey Orthopedic Surgeon Eric Heiden in the 80's.

Speedskaters have been using the slideboard for a number of years to develop skating specific conditioning and mechanics when ice surfaces were unavailable. In the past ten years hockey players and other athletes have begun to utilize the slideboard as part of their off-season and preseason training.

The slideboard may be the most “bang for the buck” in the world of work capacity or conditioning development. No other piece of equipment can do all of the following:

- 1) Place the athlete in a sport specific position (Almost regardless of sport)
- 2) Positively stress the abductor and adductor muscles
- 3) Allow athletes to work in groups of three to four on one piece of equipment
- 4) Provide work capacity training in an interval format for 3-4 athletes with no adjustments (seat height etc.) for under \$600.

All of our athletes, regardless of sport, will perform lateral conditioning on the slideboard 2 times per week during a four day work week. In fact the slideboard may be the best, most cost effective conditioning mode available for athletes exclusive of actually running.

In training for the game of hockey the slideboard may be the most important training device available to the hockey player. Until the advent of commercially available slideboards hockey players were relegated to off-season training on an exercise bike or on a track. Although both techniques, running and biking, can increase aerobic capacity and anaerobic endurance there is little similarity to the motion of skating. The slideboard provides a highly specific method for performing work capacity workouts for hockey players. In addition the slideboard allows the athlete to improve skating technique. Athletes can easily self correct as they view their knee flexion, knee extension and ankle extension while training on the board when the board is placed in front of a large mirror. The mirror will provide an immediate feedback mechanism for the athlete.

The slideboard also reduces the player’s chance of incurring a groin injury in pre-season. This is one of the reasons I like the slideboard for any sport. The motion of the slideboard works the abductor, adductor and hip flexor muscles, something that does not occur on a bike or while running.or

In addition, for hockey players the combination of plyometrics, land sprints and the slideboard is a major part of improving on-ice speed.

Training Program Ideas

A slideboard training program can be developed using simple interval training concepts. Athletes should begin a slideboard program with some introductory workouts of one part work to three parts rest. (30 secs work 1:30 sec rest). This is a great basic program designed to familiarize the athletes with the concepts of interval training on the slideboard. Up to eight to ten intervals can eventually be performed. This generally results in heart rates of 160 to 190 beats per minute. These programs will actually be aerobic if the heart rate is maintained above 120 beats per minute during the recovery period. However the real purpose of the slideboard is to provide an excellent anaerobic endurance workout. You may manipulate the work to rest ratios to meet your own needs.

Technique- Athletes should maintain a knee bend of 120 to 130 degrees (Figure 1). Emphasis should be placed on extension of the ankle, knee and hip joints. When you reach the end of the board, think about trying to touch the knee of the push leg to the calf of the leg that has just arrived at the bumper. The hips should stay at the same level the entire time you are on the board. We tell our athletes that if could plot the position of their hips on a graph it would ideally be a straight line. Athletes are also instructed to not bring their foot behind their body. The recommended length of the board is one and one half times the athlete's height. For this reason most of our athletes utilize a 9 foot board.

Suggested Guidelines

<i>Work Interval</i>	15- 30 sec
<i>Number of Intervals</i>	Begin with 5
<i>Rest Interval</i>	45 sec- 1:30 sec
<i>Length of Workout</i>	10-50 minutes

Please note: Work intervals longer than 30 seconds usually result in loss of technique and are recommended only for advanced athletes with great leg strength. Rest intervals should be 2-3 times the work interval. We generally try to increase the number of work intervals or to decrease the rest time rather than lengthen the time interval. A simple two day per week slideboard program is illustrated.

Slideboard Conditioning Program- based on 2 lateral emphasis days per week		
	Day 1	Day 2
Week 1	5x:30-1:30	6x:30-1:30
Week 2	7x:30-1:30	8x:30-1:30

Week 3	9x:30- 1:30	10x:30-1:30
Week 4	7x:30-1:00	8x:30-1:00
Week 5	9x:30-1:00	10x:30-1:00
Week 6	7x:30-1:00 add 10 lb vest	8x:30-1:00 add 10 lb vest
Week 7	9x:30-1:00 w/ vest	10x:30-1:00 w/vest

