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The Implications of leg position for Wrist Shot in Junior Ice Hockey

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Abstract

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The purpose of the study was to establish the efficiency of wrist shot from two legs compare with one leg wrist shot in junior level.
The research was started in the beginning of 2010 in the winter and it was finished in the late spring of 2010. The collected data from research was introduced for all of the coaches and some of the teams in Gota Traneberg club.

GötaTraneberg club is one of the biggest ice hockey clubs in Stockholm and club has more than 100 years history. Their level is different comparing different age groups. The last two years I was watching a lot's of games and compared the results, starting U14, U15, U16, B junior, A junior and Men's teams. All these teams had the problems with scoring efficiency. During the whole season the teams has scored just over 50 goals comparison with other clubs 100 goals. Those results definitely have to be changed in nearly future.

The thesis presents the researches made in shooting tests. In the researches were tested 10 players (the players are born 93, 94, and 95) in two types of wrist shooting: Two legs wrist shot (regular wrist shot) vs. one leg wrist shot (quick release).

Key words
Two legs wrist shot, quick release, one leg wrist shot, explosiveness, ice hockey

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1 Introduction

Many young coaches reading many different books they trying develop them self and many of these books are saying , there is no one system, no best system, no secret system, it's the coach's responsibility to create an atmosphere and environment that gives shape to that enthusiasm. Games are fun; however, need to remember that their job is to bring these players to life (Smith, 1996, 4), teach them how to become more successful in the future.

A lot of nowadays coaches are trying to bring good atmosphere in the team, they using creativity with many different drills and very interesting other activities but this keep's until the next game. Then coaches analyzing what was not ok that day and another game the same again and again. I just want to tell that many situations are when we all able to see very far away but we not able to see very close, the simple things. Sometimes we need to make that step back and to give for young athlete's very simple drills, skill elements or some other things to learn. All what is based on teaching and learning having good results, success in the future and atmosphere too.

So my work is that step back into wrist shooting technique, the most accurate shot in ice hockey. The two most commons types of wrist shot are:

1. One leg shot – quick release, with the whole body weight on one leg in which most strength comes from the wrists and the body weight flexing the stick shaft. This is the most common shot at the professional level.
2. Two legs shot – when the body has very good balance on two legs and this shot involves the coordination of many body muscles, the strength comes from legs, core and upper body. This is the most common shot in youth hockey.

The problem of the topic studied lied in the fact that there is no unanimous opinion of what is the difference between the quick release wrist shot and regular wrist shot. The Canadians say that the two legs wrist shot is 40% stronger than one leg wrist shot. They claim this extra 40% comes from the whole body, starting from legs, trunk, upper body and arms. The Russians say that there is no difference in professional level what kind of wrist shot the players are shooting.

The researches/studies shows that the type of shot (wrist or slap), velocity, and accuracy of the shot in relation to the rigidity or flexibility of the shaft. The rigidity or flexibility is related to the parallel plane of the blade. The wrist shot and slap shot, the comparison reveals that the time for a wrist shot is greater by approximately 0.125 s to puck contact and by a total elapsed time of 0.250 s for completion of the shot (Hoerner, 1989, 161).

2. Development of physiological factors of the body

2.1. Flexibility for hockey players

Areas of the body of special concern to hockey players, when it comes to flexibility, are the hamstrings and the lower back region (Twist, 1997).

During the skating stride, the hamstrings are rarely stretched to their full length. Muscle will shorten when not used to their maximum length, lack of full extension during skating results in tightened hamstrings, which, over time, lead to back injuries or groin pulls. Heightened flexibility at the hips, groin, hamstrings, and thighs will not only prevents injury but also improves skating speed, footwork and shot quality (Twist, 1997).

Special preventive attention is needed in the lower back region. Hockey players skate with a slight back flexion, which places demands on lower back strength and flexibility. Without specific preparation, the lower back will not withstand the continual isometric contraction of the back extensors in the skating position and in the stressful twisting actions that occur during the game, such as the forceful trunk rotation when shooting (Twist, 1997).

Flexibility training can increase a muscle's range of motion. Good flexibility is important for fluid movement, long skating strides, and injury prevention (Twist, 2007, 29). Uneven muscle flexibility can come from preferentially shooting off one side, stopping more often one side, loading up one leg more than the other to generate the power striding forward, leg length discrepancies, and past injuries that led to compensational patterns in the body (Twist, 2007, 29). To improve on ice performance, player should focus on achieving balanced flexibility rather than excessive range of motion. The players must be in tune with their bodies, sensing what muscles are more restricted, applying more stretching volume to tighter body parts (Twist, 2007, 29).

2.2 Balance

When an unstable surface is introduced to an exercise, the additional balance change increase the number of muscle groups recruited, muscle activation within each group, and overall metabolic cost, eliciting higher heart rates for a given exercise. The body adapts with improved

muscle endurance as well as the energy systems that fuel the heightened efforts (Twist, 2007, 104).

Balance is all about coordination and body control. It improves the mind-muscle connection, making muscle more responsive to challenges and compliant to commands from the brain. Balance exercises focus on kinesthetic awareness, teaching players to be in tune to their bodies. Players learn to adjust mechanics and shift weight to load to a more advantageous position (Twist, 2007, 104).

Hochey players require balance to perform aggressive edging when turning and cornering. Tight turns necessitate the ability to bring the body's center of mass far outside the base of support. Skillful skating uses single-leg balance while skater pressures different parts of the skate blade. Shooting and body checking are also well served by establishing the perfect position of balance during the dynamic action needed to execute those skills. Balance enables players to produce the power required to generate a hard shot or a strong check (Twist, 2007, 104).

With training, minibrain sensors become more sensitive. They identify deviations sooner, thus shortening the neural response loop. Information is processed quicker, and response accuracy improves. The muscles receive precise, accurate instructions appropriate to the on-ice challenge (Twist, 2007, 104). When body parts change position, the information is detected and sent to the brain, which acts like a computer to determine what movement is needed to select a more skilled body position.

Balance drills are also designed to improve joint stability by removing weak links in the body. More specifically, balance helps transfer training results to hockey-specifics strength, movement speed, and reactive agility. Although a balance stance and a linked body increase the force that a player can create in a standing position, which helps when battling for a puck or blasting shot, skilled movement is not always about producing the most force. For optimal skill execution, some muscles must contract powerfully, other muscles must stabilize, and still others need to relax. Some of the working muscles need full-out efforts; others need to apply a small amount of force. Becoming in tune with the body to learn how to play just the right amount of force enhances skilled and fluid movement (Twist, 2007).

2.3 Strength and Power

General strength is about tuning up the body and providing a foundation. Players a less susceptible to injury and can tolerate greater amounts of advanced hockey-specific training when they develop a base of strength throughout the entire body, taking care of any weak links in the kinetic chain (Twist, 1997).

> Even in the NHL, I have observed aspiring players who report to camp with far too much upper-body bulk, which changes their center of gravity and interferes with fluid performance of skills. Training like a bodybuilder or like those whom you see in a health club serves one purpose- to develop bigger muscles. Bigger and stronger is good, but for hockey, a massive upper body relative to the core and lower body is counterproductive. Bigger and stronger is useful only if it is achieved with a lifting style that makes one a better athlete, not just a better weight lifter. Bigger, stronger, and smarter is the goal. While the athlete is getting bigger and stronger, the goal is to train movement, not muscle (Twist, 1997)!

For hockey players need a strong core; big, powerful, quick legs; and a strong upper body without excessive mass that will inhibit puck handling and slow them down. Strong legs, hips, and core topped with upper-body strength in pushing, pulling, and rotating patterns linked with forearm strength allow players to shoot hard, win the battles along the boards, be strong in the face-off positions, and protect the puck. Specific strength exercises will transfer better to on-ice situations, especially when strength is trained as power with explosive lifting tempos. Power initiation is best transferred onto the ice with exercises that use the body mechanics and joint angles similar to those used during the game action (Twist, 1997; Twist, 2007).

2.4 Explosiveness

Explosive power is need to fuel accurate, high velocity shots; accelerate to top-end skating speed (Twist, 2007, 105).

The explosive force – is the maximum force, manifesting throughout the shortest time frame jumping, throwing, shooting in the net (Stonkus, 2002, 52).

The explosive force is described as muscles – nerve system capability, which produces a maximum pulse over a certain period of time. The ice hockey player has a little time (less than

250ms) to rise up the impulse, and then it comes a maximum starting force and manifesting of explosive force (Grosser & Starischka, 1993, 178).

Explosiveness-ability of human being of a movement, action, under certain conditions in the shortest period of time or the ability to perform human-specific body parts to move, or their complex, rapidly transfer all body weight from one place to another, to develop a high body mass movement speed in a short period of time (Stonkus, 2002)

A given speed of movement guaranteed by the motor systems to specific task, the execution environment and rational intramuscular coordination, determining the entire nervous and muscular systems of individual capacity adaptation (Verchoshansky, Wilmore & Costill, 2001). (Verchoshansky, 1988) original: Верхошанский, 1988.

The most reliable way for physical development of the athlete, not the week side or weaknesses development but the maximal development of important individual characteristics (Platonov, 1997, 92). (Платонов, 1997) original: Platonov, 1997.

2.5. Agility and Reactivity

In hockey game, agility and reactivity can make the difference in a number of offensive and defensive situations. High speed agility and reactivity are undoubtedly the strongest discriminators between star major pro player and stalled minor pro players (Twist, 2007, 137). Nowhere is this more evident than in ice hockey, in which strategies follow a pattern of read, react, and explode.

Reactivity refers to muscle responsiveness, the ability of a nimble mind take a quick decision and whole-body adjustments to environmental challenges. The speed of muscle responsiveness is moderated by the mind for responses that are not reflexive but actually reactive (Twist, 2007, 137).

Reaction time is moderate by agility, which provides the fluid movement skills, and reactivity, which contributes fast responsiveness of booth the mind and the muscle to seed direction change (Twist, 2007, 137). Speed development is essential to the development of agility. However, simply working on a straight-line speed will not maximize athlete's agility. Techniques that involve agility must also be developed (Bompa, Haff, 2009, 146).

Successfully shooting, passing, hitting, skating and other skills feed into one-on-one tactics and rely on agility and reactivity. Each moment in ice hockey game is completely unpredictable. Events on the ice change suddenly, so players must be able to shift body position quickly, whether carrying the puck, trying to get a shot, or defending the net from attackers (Twist, 2007, 137).

Another component of agility is perceptual decision making, which is related to reaction time or visual scanning, anticipation, pattern recognition, and knowledge of situations. This has been termed reactive agility and is marked by the ability to react to a situation, which appears to differentiate players of different levels in various sports. Specific drills are needed to develop this type of agility (Bompa, 2009, 146).

2.6 Linked system training

To execute successful shooting, player needs integrated coordination of their entire bodies. The body is a unit of linked system that work together to coordinate athletic actions. Linked system train is the key to building skillful coordinated on-ice movement, eliminating all the weak links in the kinetic chain (Twist, 2007, 70). It is very important especially for players, who come from a traditional exercise background and have experienced injury in their hockey careers. Week links lead to muscle imbalance and repetitive technical flaws that affect hockey mechanics and, over time, set up the body for injury. Whole-body lifts that draw muscle from toes to fingertips aim to correct these weak links and imbalances. Hockey players must reestablish the mind-muscle links, reactivate the lines of nerve-muscle communication, and regenerate the coordinated strength that, all together, facilitates skillful, whole body on-ice actions (Twist, 2007, 70).

2.7 Adolescent physical, physiological features of the body

Researches approved that early specialisation doesn't give any guarantee for high results. Every coach before planning he's practices should take into consideration age of athlete, must know the methods and characteristics of development physical capacities in different age groups. It is a big mistake for young athlete practice in very special way, use very special conditioning exercise. The specialized development program of young athlete in early age can decrease chances to reach very high results in the future (Ingle et al., 2006).

Children and young age is highly unusual in that it is intense in the growth process. At the same time stabilizes certain relations between the individual body systems, and central nervous system (CNS) (Rowell &; Ingle, et al., 2006, 989). The child's maturation is congenital, inherited and acquired characteristics of personality variation. Child matures, the rapidly increasing size, changing the functional system of organs, the formations of personality traits, movement changes (Karoblis, 2005).

Biological maturation is a critical factor in determining the physiological response to physical activity (Rowland, 1996). Clinical response to physical activity affects the functional and morphological changes in systems. The very nature provides an opportunity to individuals to depart from the norms of the stages of maturity (organ development pace of change during the evolution). D. Martin (1993) suggests that the child develops individually and differently.

Individual development depends not only on the innate characteristics, but also an effective environmental impact. Children that mature earlier are often physically superior and show very good results. The slower maturing children often close this gap later on and end up bypassing their quicker developing peers. Coaches, selecting athletes have to pay attention to the potentially strong but later maturing (Busso, & Karoblis 2005, 428).

Adolescent psychological functions development is a complex mechanism: the number of cells, increase in cell size and cell distribution of functions may lead to physiological reactions to physical activity (Karoblis, 2005). Regular physical activity results the increase of cardiovascular functional capacity (Poderys & Vainoras, 2004, 191). Heart functionally often limiting factor, limiting the body's adaptive potential, resulting in cardiac adapting to large physical exercise is one of the key conditions that determine the overall adaptation of the host organism in surrounding environment.

Growth of the organism, the first 10-15 before it evolved in the body of blood flow redistribution mechanism, the main importance of increasing the employability of heart during exercise, has heart rate, while older people, resulting from changes in blood vessels, leads to variations of the prevailing arterial blood pressure variation. Cardiovascular changes in the system determine that physical activity at different age stages, activating the different physiological adaptive mechanisms (Poderys, 2004, 202).

Exercise and sports training have an impact on psychomotor features, as may be annoyed different receptors, which may vary a psychomotor reaction time. Exercise can improve athlete's psychomotor reaction time, but the progress can be not vey high, because many of the phenotypical adaptation lead to evolution. The greatest impact has on the sport, where need to react quickly to external stimuli. It is short-distance running, fencing, boxing, wrestling and other sports (Busso & Skurvydas, 2008, 606).

So young athlete body is different from adult human body. The adolescent adaptation quit good to an adults training regime, but training programs for children and adolescent has to be considered in each age group individually, taking into account all the physical factors of development (Malina, 1991, 67).

The results show that, before the sexual maturity the sport regime is does not adversely affect growth and body constitution of children are important factors in the choice of sport. All young athletes compare to sedentary youth shows much better maturity. These comparisons not only demonstrate the undeniably positive training but also the impact of the selection process. Physically better mature adolescents reaching better results and faster becoming athletes (Wilmore, Costill & Damsgaard, 2000).

According to Depairon (1996), puberty activates metabolic process, more energy wasted handling the physical work, and therefore last longer recovery period. In addition to direct the body's reaction to physical stress, it is noted more pronounced against the start various function changes: increased heart rate; blood pressure rises; deterioration reaction, even during the race is disrupted coordination. Adolescents characterized by stormy emotional reaction of the various functions overloaded in competitions and much smaller changes in laboratory testing to calm conditions. Education and the precise movements requiring improvement exercise must be linked not to the limit, but only with moderate-intensity efforts (Depairon, 1996).

11-17 years of age individual recovery processes after physical exercise, which focuses on the characteristics of speed, going much faster than adults, but if the exercise highlights the endurance characteristics of the load gradually increases to a certain voltage, regenerative processes take place much more slowly than adults. That means, if for the children we will not apply the individual physical loads, their recovery period will be much longer then adults (Karoblis, 2005, 429).

3. Wrist shot

The wrist shot is probably the most effective shot in hockey. It is the most accurate shot and it can be released fairly quickly. This is the shot that a player should learn first. While not as fast as the slap shot, with practice, proper technique and upper body strength, the wrist shot can be a very powerful shot (Hoerner, 1989).

WRIST SHOT – The player should use the proper stick grip and should take the proper hockey stance. For the wrist shot, the player has to move the lower hand halfway down the shaft to add power to the shot, position of the body at a 45-degree angle to the net (see the figure nr. 1). Bringing the puck behind or even with the back leg lowering the shoulder as it will reach back and down with the stick position the puck. Keeping the puck on the heel of the blade or in the middle of the blade with the blade tilted over the puck (rotating wrists). In this position, body weight should be on the back leg (Gwozdecky, 1999, 3).

There are four main elements to an excellent wrist shot (Tarasov, 1986) original: (Тарасов, 1986, 51).

- starting puck position
- weight transfer
- stick speed
- follow through

- **Puck Position**

Correct positioning of the puck is very important. If the puck will not get correct position it will never achieved a good wrist shot. The puck should be situated at the heel of the blade of the ice hockey stick, than it's possible to make a good shot but if the puck is incorrect position around the body, to far, to close, the player starts perform un normally. The body position goes on the toes, loses the balance and breaks the players correct shooting habits (Tarasov, 1986, 52) original: (Тарасов, 1986, 52).

- **Weight Transfer**

This is the secret to a powerful shot. The more weight the player can manage to transfer through the body, the harder shot will become. The player doesn't get to take a swing at a wrist shot so he has to make up with that lack of power here. At first the player weight should be evenly distributed across the body. That the player would made the wrist shot, he should transfer the body weight from back leg (the one farthest from the target) to the front leg as the progress through the shot. The puck rolls along the concave side of the blade as the player's weight is transferred to end up on the tip. At the final point the puck is snapped off with a flick of the wrist. Ideally the player should end up with 100% of he's weight on the front leg, with the back leg hanging off the ice as a counter balance (Tarasov, 1986, 52) original: (Тарасов, 1986, 52).

- **Stick Speed**

The skilled player and less skilled player shooting the puck with the same amount of force, but skilled players have a lower kick point of the shaft and have a higher blade-contact time resulting in a higher puck velocity (Gilenstam, 2008, 106).

To move that puck at speed the player is going to need to be able to move he's ice hockey stick at speed and that takes training. Daily rounds of pull-ups, push-ups and sit-ups will improve the muscle strength and endurance too. Next step is the practice ice. Getting the shots as hard as he can do and non stop till the player cannot go on. Letting the player rest for a few minutes and start the process again (Tarasov, 1986, 53) original: (Тарасов, 1986, 53).

- **Follow Through**

This is the all important aiming training. What is the point after all of whacking a puck through the sound barrier if it goes wide of its target? The puck will follow the direction where the player pointing the stick at the end of the shot. Keeping the player eyes focused on the target and don't letting be the player tempted to give all he's attention to the puck, to the stick stick, or the puck's flight through the air. Letting the player choose different areas of the goal to shoot into - top left, middle, top right, bottom left and so on. The next step is to do it with a live goaltender in place (Hoerner, 1989).

The wrist shot is performed by a player who brings the puck backward along the ice in contact with the blade of the hockey stick. Afterwards, the shot is brought forward rapidly in sweeping action and is terminated by a wrist snap and fallow-through which accounts for the maximum velocity of the shot. The length of the backswing and the amount of wrist action varies among different players. In the skating wrist shot the player is skating forward toward the target while maintaining contact with the puck and performs a sweeping action (Hoerner, 1989, 156).

These shooting mechanisms indicate that the proper timing and coordination of acceleration and declaration of the sequence of motion of the body segments produces the maximum velocity of the shot. The combination of the different anatomical areas of the body, the trunk and the legs, associated with the dynamics of the hockey stick, result in maximum velocity with power, associated with quickness and accuracy (Hoerner, 1989, 160).

The hockey stick is an often overlooked aspect of developing shooting, passing, puck control skills. The stick is the main tool to reach their desire goals on the ice and become a star player. With the technologies now available, type, size, and shape options has increased dramatically. Before that was only wooden sticks available, now players can choose from a variety of makes and models. When choosing a stick, players should consider their needs and style of play. Now days most of the players are playing with composite sticks and new generation of ice hockey players not even want to think about the wooden sticks. With all the options available, players should try as many different sticks as possible to find the right one (Gwozdecky, 1999).

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"Some of the principles outlined here mirror important aspects of other skill areas including shooting and puck control. As with all skill development, practice is essential for success (Gwozdecky, 1999)".

3. 1. Proper stick

Stick lie – it is important to have as much of the stick blade on the ice as possible. Stick lie affects this greatly. Stick lie is the angle formed by shaft and blade. The higher the lie number, the more upright the stick is when the blade is flat on the ice. A good way to check if a player using a stick with the correct lie is to examine the bottom of the blade after the practice or

after the game, to see where the tape is wear along the bottom, at the toe or at the heel of the stick blade, ensure that he is wearing evenly, not just on the heel or toe (Gwozdecky, 1999).

Stick length – Stick length determines the puck position relative to the player's body and directly influences passing, receiving and shooting. A longer shaft forces the puck away from the body. Stick length can be important in executing or shooting effectively, so it's important to try different lengths for both comfort and efficiency. Player should experiment with different stick length to find the fit that feels most comfortable to them. The old adage that a stick should be cut at the same level as a player's nose or chin is not valid (Gwozdecky, 1999).

Blade curvature – Younger players often mistakenly use a stick with more curvature than they are ready for, they trying to lift the puck as high as it possible and if it doesn't work they aiming for a stick with the big curve. This step can hinder their development of shooting, passing, receiving skills. For beginners, we recommend a blade with less curvature. Once sound foundational shooting, passing, receiving habits have been established, a player can switch to a blade with greater curvature. A sensible rule to follow is the younger the player, the straighter the blade (Gwozdecky, 1999).

Player should consider stick lie, stick length, blade curvature and one more very important thing – shaft stiffness before choosing a stick.

Shaft stiffness - in the other words stick flexibility.

Hockey stick flex is a measure of how flexible or how stiff a hockey stick is when a force is applied to it. When a player bends his hockey stick when taking a shot, it essentially turns the hockey stick into a spring storing energy. When the spring is released (when the stick unbends and returns to straight), the energy is released and accelerates the puck. (Hoerner, 1989, 161).

Mid flex – Mid kick point, or mid /constant flex, sticks have a more traditional flex that allows the stick to be loaded from the bottom hand. This gives for a player a larger loading and potentially a higher velocity release. Wooden sticks have a constant flex profile.

Low kick points – The kick point where the shaft flexes when enough pressure is applied to bend it. Composites sticks are often engineered to have low kick points on the shaft for a quicker release. The loading of the stick happens sooner since there is less distance for the

stick to bend before it recoils back and whips the puck forward. This lower kick point is often created with shafts that have tapered ends near the blade.

The most common measurements for stick flex are:

Youth = 40 flex
Junior = 50 flex
Mid or Intermediate flex = 60-75 flex
Regular flex = 85 flex
Stiff flex = 100 flex
Extra stiff = 110 flex

3.2. Two Legs Wrist Shot

Every player must execute powerful, accurate and consistent wrist shot.

A player must understand the importance of proper hand, arm, and elbow flexion and stick positions relative to the body to shoot or pass a puck effectively:

- Stick grip – the player's hands should be comfortable distance apart on the stick shaft. The further down the lower hand is placed, the more the player needs to bend at the waist.
- Legs – legs should be spread in shoulder wide, knees are bend, toes not facing the target.
- Head – not to high not to low, so that easily catches a glimpse of the puck on the blade while focusing on the intended target.
- Body position – there are two most crucial points; body weight and the center of gravity - balance. In this wrist shot body weight is transferring from one leg to another leg.

  Balance – staying on inner edge or straight edge on the skate of the blade.

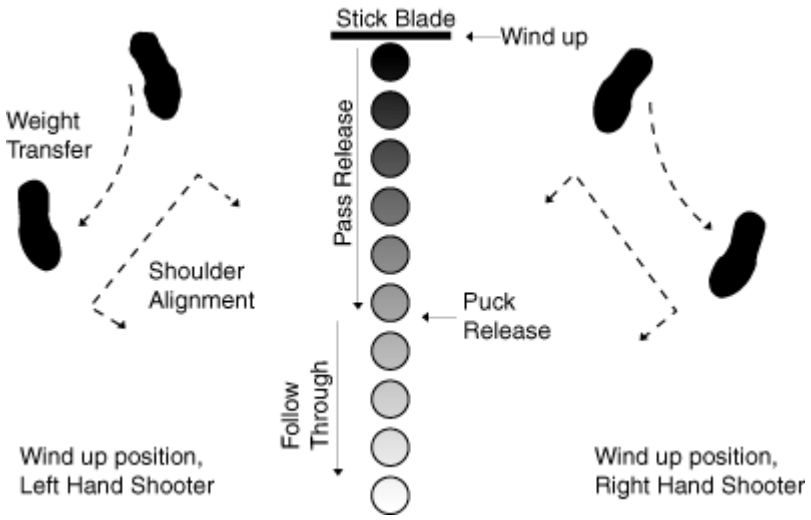

Figure 1. The standing player position in regular two legs wrist shot. (Hockey tips, 2008).

According to Gwozdecky (1999, 6), there are three very important zones in wrist shooting:

1. Zone 1 is the setup area at the beginning of the shot; the shot begins with puck behind the body and keeping the body weight on the back foot. In this zone comes the biggest power, strength of the shot. The most power comes from the legs and upper body's swing. The puck is covered with the stick until he will reach the front skate, then the blade opens.

2. Zone 2 is the release location, an extremely important element in directing the puck, effective shot. Moving the body weight from back foot to front foot. It is very important to develop legs muscles to increase the speed and strength of the shot in phase nr 2. To transfer the strength form legs muscles to upper body muscles. Generation of the speed.

   Technical skills are the most crucial, especially in stick handling, controlling the wrist work out. The puck must move from the heel of the blade to toe of the blade and spin. The key point is to hold the stick properly.

   Technical elements:
   Holding the stick top hand's thumb has to point down straight to the ice.

3. Zone 3 is the following-through area into which the player carries the stick as the puck is released. It's also helps the player shoot the puck into the target.

3.3. One Leg Wrist Shot

Another wrist shot, one leg ("quick release shot") shot the strength is generating from the body more to the stick or to the shaft of the stick. Now days the wrist shot style: "not the body generates the power in the shot but the body weight on the shaft and shaft generates the power" (Rossiter, 2004, 53).

One leg wrist shot – is the toughest and fastest shot for a goalie to take. The player can shoot near he's feet's; there will be now big fallow trough and it will be harder for goalie to know what's happening. This shot is a combination of wrist shot and slap shot. With a good one leg wrist shot the player can surprise the goalie and the player can take this shot in middle of action in the middle of players. It's a hard shot to learn but it will be worth to train (Rossiter, 2004, 53).

This kind of wrist shot is requiring practicing more than other shot's. Shoot from every spot in quarter of a circle, go from forehand side near the front skate to the right which be will pointing out from the body. Making a hard breath that will generate the power (Rossiter, 2004, 53).

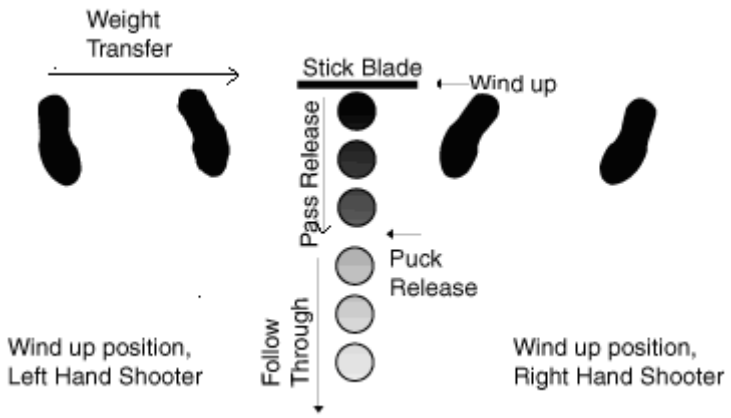

Figure 2. The standing player position in one leg wrist shot

1. Zone 1 is the setup area at the beginning of the shot; the shot begins with puck a little bit behind the body, a little bit behind the heal, and keeping the body weight on two legs. In this zone comes the biggest preparation for the shot with lateral body

weight move from one leg to other leg, bringing the whole body weight on one leg close to the stick. Upper body leaning to the side of the stick.

2. Zone 2 is the release location, an extremely important element in directing the puck, effective shot. Moving the body weight with lateral move from two legs on one leg, to front leg (leg closer the stick). It's very important keep the front leg bends; keep the balance, to increase the speed, strength and power of the shot in phase nr. 2. To transfer the strength from whole body to the stick and explosiveness and quickness to the wrists to generate the speed and the power of the shot. In this part the technical skills are the most crucial, especially in wrist work out. The puck must get extremely high power and speed during very short time. The body weight on the stick shaft and the stick shaft generates the power. One more important thing in this zone – the other leg. During the motion second leg has to be lifted up in the ear.

3. Zone 3 is the following-through area into which the player carries the stick as the puck is released. It's also helps the player shoot the puck into the target. After follow-trough it's very important to put second leg down on the ice as soon as possible, to bring the balance back in normal position.

Hands:

Hold a stick that the blade would be on ice. Keep the wrist stiff during the hit and make a very short fallow through. The puck will hit the middle of the blade. The hit should be hard and short.

Fallow through:

Keeping the balance; many players falling to the side or backwards. Back skate has to rise from the ice into to the air, so it's very important for the player is look after the opponents.

4. Research problem

The purpose of the study was to establish the efficiency of wrist shot from two legs compare with one leg wrist shot in junior level.

To show the difference in shot speed between the quick release wrist shot and the regular wrist shot.

To see what kind of impact makes players selected stick performing the shooting.

The results use for further researches and create development program of shooting for junior level (U13, U14, U15, U16) in the club, to avoid of bad shooting habits and increase scoring efficiency.

5. Methodology of Researches

5.1. Participants

Ten players from one ice hockey club but from different age groups were selected for their developed wrist shot skills and informed consent was obtained. The participants were instructed to avoid heavy resistance training 1 day before the tests and were instructed in 30 min class session, before the test, to reach better goal during the tests. The players were selected from "Göta Traneberg" club (Stockholm, Sweden) and their age were between 14 and 17, their average hockey experience was 8,1 ± year, the weight was 73,8 ± kg, the height 180,2 ± cm and stick stiffness was 96,4 ± flex (Table 1.).

The researcher were held in Stora Mossen arena 19th of March in 2010.

Table 1 Anthropometric data, age and ice hockey experience.

Participant	Height (cm)	Weight (kg)	Age (years)	Exp (years)	Stick Stiffness (flex)
1	166	56	14	7	79
2	183	75	14	7	75
3	182	86	16	7	95
4	185	70	16	7	102
5	183	70	16	8	79
6	193	85	17	10	102
7	180	70	16	8	85
8	174	76	16	9	100
9	172	70	16	9	80
10	184	80	15	9	80
Average	180,2	73,8	15,2	8,1	96,4

5.2. Stick and pucks.

The players used their own sticks, their model and stick stiffness were different.

All players' had their own sticks with different shaft stiffness's. The stick stiffness ratings and stick length were selected by players on their own. Some of the players were over 190 cm and

over 85 kg, and their stick has more than 100 flex. The Median 82,5 of the stick stiffness (flex).

For test was decided to run with the regular match puck (6 oz and 25.4 mm thick). The regular puck in the study weighed 166-167 g.

5.3. Measuring device

The "Speed Trac" speed device (USA), was used to measure the speed of the quick release one leg wrist shot and regular wrist shot from two legs.

The SpeedTrac sports radar utilizes X-Band DRO Doppler Schift radar technology to clock speeds. The internally located antenna, when activated, sends out a radio frequency (RF) signal to a specific frequency. The signal projects from the unit like a flashlight beam, decreasing in strength with distance. If a moving object like puck, enters the device's transmitted signal, the frequency of the reflected signal of the puck is changed or shifted. This Frequency change is proportional to the puck speed, and the SpeedTrac sports radar's internal circuits instantly process the return signal to display speed in MPH or Km/H.

The SpeedTrac sports radar's projected signal is able to pass, unaffected through certain materials, such as netting, wire mesh fencing, tarps or backdrops, and Plexiglas.

A target passing at an angle through the signal will result in a displayed speed that is lower than the target's true speed. As an example of the magnitude of error potential, a 10º entry angle reduces the actual speed by about 2%.

Measuring device located behind the net, see the figure 3 (below).

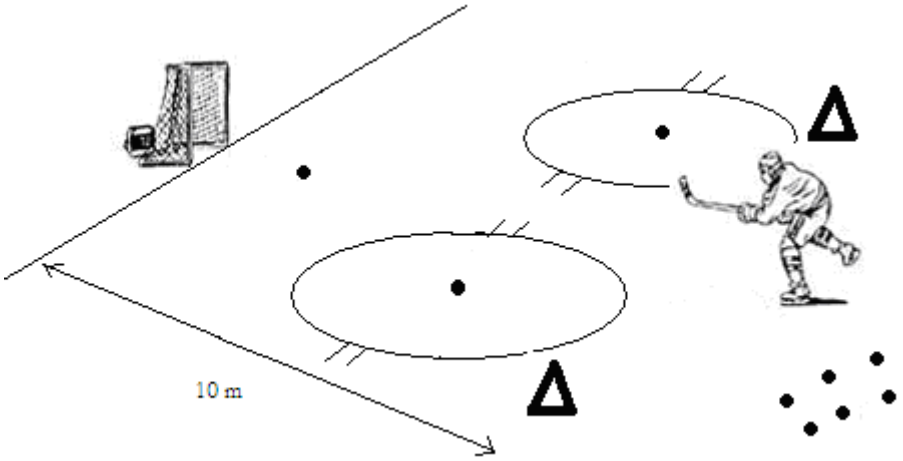

Figure 3. **Test procedure**

5.4. Test procedure

The wrist shot test was performed in regular ice hockey arena and the players were half dressed (helmet, gloves, elbow protections, and jersey). Before entering the ice the participants fill in the questionnaire (see the appendix nr. 1) concerning the information about anthropometrics, training, career and stick stiffness.

Each participant made one set of shots with both style of wrist shot. A set consisted of a three shots in one wrist shot style and then three shots with the other shot style. The participants were allowed to practice shots for 10 min before the start of each set as well as at the change of the shot type. A shot was registered when the shot was registered by the measuring device, the puck hit the goal and the participant was satisfied with the shot. The number of shot that missed the goal was registered in each style of a shot. The top one velocity for each type of a shot was included in results.

7 participants had to make additional 22 shots, out of 120 shots in total, as the puck misses the net and 6 shots (included in 22) were not registered of sensors of electronic device.
The shots were made approximately 10 meters away from the net, and plus 1,3 meter (distance behind the net) to the Speed Trac device. The Speed Track manual says that the most efficient distance between 6-7 meters but I have been consulted of Sweden Hockey Institute and that the best way to extend the distance because sometimes the sensors of speed device can measure the speed of the blade but not the speed of the puck.

6. Results

Most of the players had much better results with the regular wrist shot from two legs than from one leg. The wrist shot with one leg requires much better balance, strength and power. The players which showed better results had better stick handling skills. Eight of the ten players showed higher results from two legs wrist shot and only two players made better results from one leg wrist shot. Those two players were specially selected for the tests because of their habit during the practices and games of shooting from one leg.

Table 2 Puck speed (km/h) with different shot style in stationary position

Participants	One leg wrist shot (km/h)	Two legs wrist shot (km/h)	Faster two legs wrist shot (km/h)
1	83	84	+1
2	85	89	+4
3	81	85	+4
4	79	82	+3
5	93	102	+10
6	72	76	+4
7	75	83	+8
8	80	83	+3
9	85	98	+13
10	73	76	+3
Average	80.6	85.8	5.3

From this position all of the participants showed better results in two legs wrist shot than in one leg wrist shot. The biggest difference was (<13 km/h). The minimum difference was (<1 km/h). The average was (<5.3 km/h), that two legs wrist shot is faster than one leg wrist shot. See the figure 4 (below).

The maximum speed of one leg wrist shot was 93 km/h, and maximum speed of two legs wrist shot was 102 km/h. The average was in one leg wrist shot 80.6 km/h and two legs wrist shot 85.6 km/h.

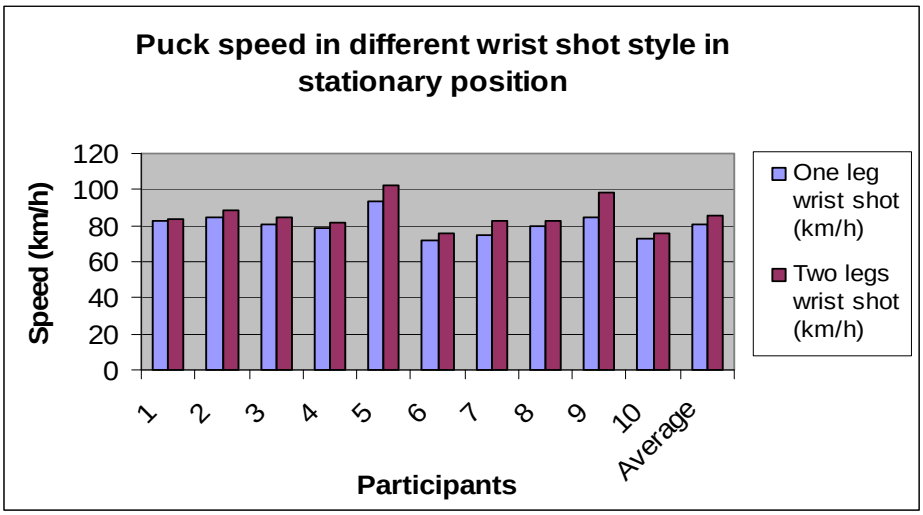

Figure 4. Different shot style in <u>stationary position</u>

From stationary position were the lowest speed of the puck as normally supposed to bee, the average speed was little bit over 80,6 (km/h) with one leg wrist shot and 85,8 (km/h) with two legs wrist shot. All of the participants made better results in two legs wrist shot then from one leg.

Table 3 Puck speed (km/h) with different shot style in <u>skating position</u>

Participants	One leg wrist shot (km/h)	Two legs wrist shot (km/h)	Faster one leg wrist shot (km/h)	Faster two legs wrist shot (km/h)
1	91	88	+3	
2	91	92		+1
3	87	89		+2
4	83	85		+2
5	94	108		+16
6	76	77		+1
7	73	78		+5
8	92	95		+3
9	88	99		+11
10	92	88	+4	
Average	86.6	89.9	3.5	5.125

From skating position not all of the participants showed better results in two legs wrist shot than in one leg wrist shot. The biggest difference was (<16 km/h). The minimum difference was (>4 km/h). The difference average between two legs wrist shot (<5.125 km/h) and (<3.5 km/h) one leg wrist shot (see the table 3 above).

The maximum speed of one leg wrist shot was 93 km/h, and maximum speed of two legs wrist shot was 108 km/h. The average was in one leg wrist shot 86.6 km/h and two legs wrist shot 89.9 km/h. See the figure 5 (below).

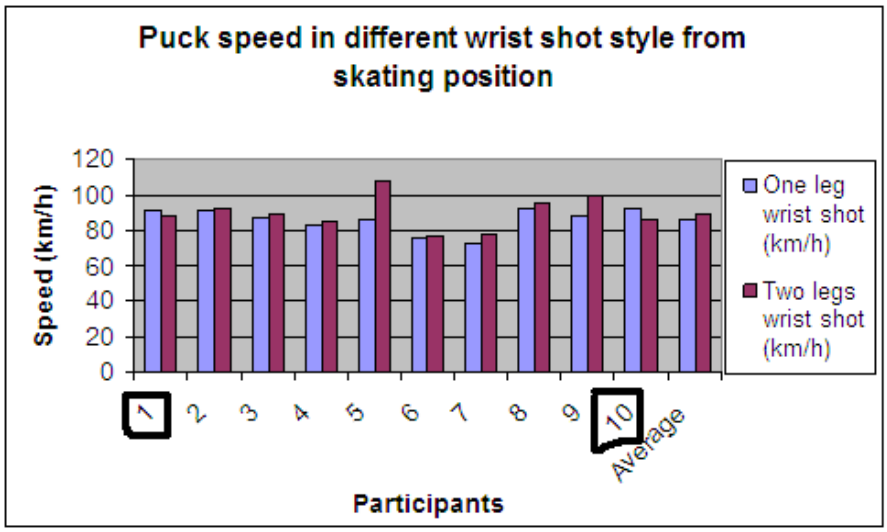

Figure 5. Different shot style from skating position

Two players (nr. 6 and nr. 7) out of ten couldn't reach 80 km/h, one of these players were the most unlucky (participant nr. 6) because he was the oldest player (17 years old) from tested group and he was nervous the most from all of the participants. He missed the net 6 times. **2 participants** (nr. 1 and nr. 10) made better speed results in one leg wrist shot then with normal two legs wrist shot. See the figure 5 (above).

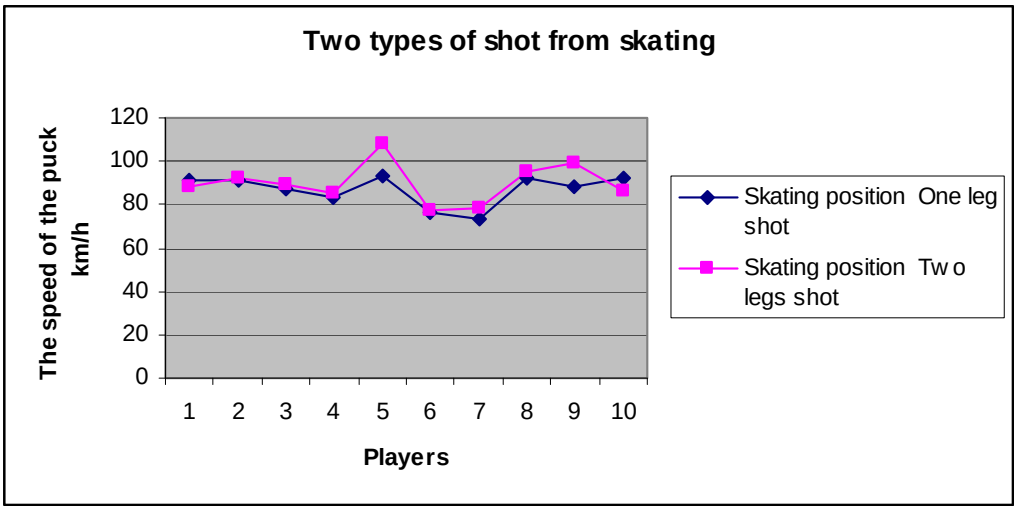

Figure 6. Different between one leg wrist shot and two legs wrist shot.

This diagram shows that only two players (nr. 5 and nr. 9) out of ten had a significant difference between the two types of wrist shot. The rest of the players have nearly the same results and some of them even the opposite, showing a better one leg wrist shot result. The present study indicates that 8 players out of 10 selected did not show a significant difference between the two types of wrist shot.

Two of ten participants (nr. 5 and nr. 9) increased puck speed when they changed their leg position and both of them had proper stick (approximately 80 flex) for the two types of shots. In stationary position the player nr 5 made <10 km/h increase in shot speed and the player nr. 9 made <13 km/h increase. In skating position the player nr 5 made <16 km/h increase in shot speed and the player nr. 9 made <11 km/h increase.

Why there is a difference in the speed of two kind of shots for some of the players and not for some of the other players? The answers could be less practice and less repetition on the ice. See the figure nr. 7(below). Some of the players also lack the necessary strength to shoot the puck at higher speeds.

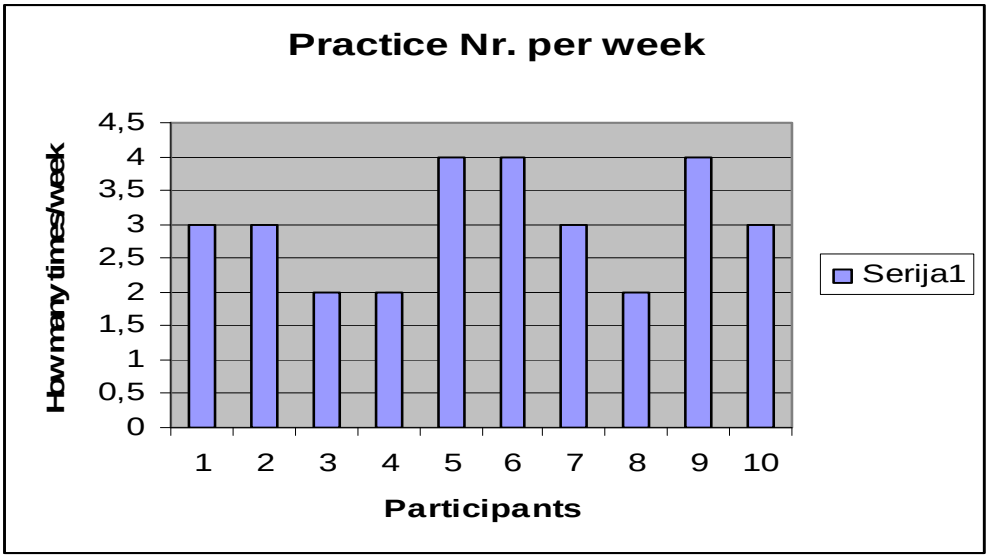

Figure 7. Players practice frequency per week.

Two out of 3 players who are practicing 4 times a week demonstrated proper shooting technique and performed well.

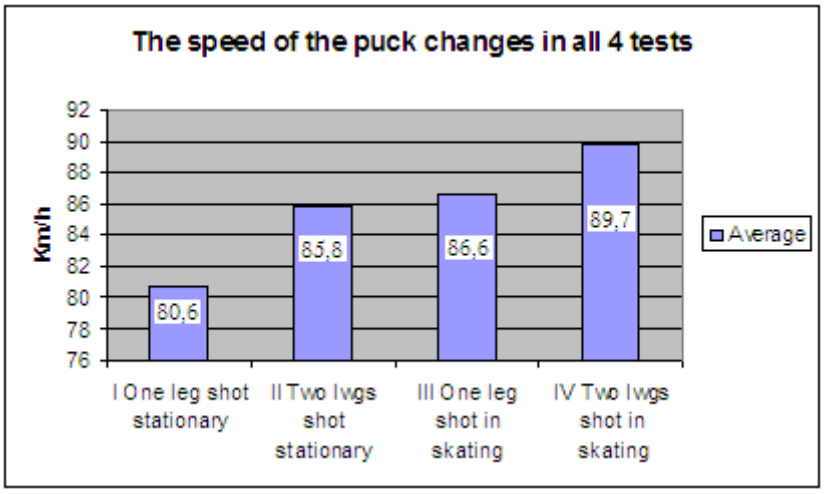

Figure 8. The changes after all 4 tests.

After all 4 tests there was significant speed change in each test. In the first two tests the shots were performed in the stationary position (test I) and there is the most speed change between the one leg wrist shot ('quick release') and (test II) two legs wrist shot (regular shot) (<5.2 km/h). In the next two tests (test III and IV) where the skating speed was included the velocity of the puck increased much more then in stationary position. One leg wrist shot puck velocity increased (<6.0 km/h) and two legs wrist shot puck velocity increased (<3.1 km/h).

Table 4 Puck speed (km/h) with different shot style in <u>skating position</u>

Participants	Height (cm)	Weight (kg)	Stick Stiffeness (flex)	One leg wrist shot (km/h)	Two legs wrist shot (km/h)
1	166	56	79	<u>91</u>	88
2	183	75	75	91	<u>92</u>
3	182	86	95	87	<u>89</u>
4	185	70	102	83	<u>85</u>
5	183	70	79	94	<u>108</u>
6	193	85	102	76	<u>77</u>
7	180	70	85	73	<u>78</u>
8	174	76	100	92	<u>95</u>
9	172	70	80	88	<u>99</u>
10	184	80	80	<u>92</u>	88

The underlined numbers shows the best shot in one of the wrist shot types. The two selected participants (nr. 4 and nr. 5) are indicated with bold lines. See the table 4 (above).
The participant nr 4 has almost exact the same anthropometric date (185cm height; 70kg weight; 7 years exp) and age (16 years old), as the participant nr 5 (183cm height; 70kg weight; 7 years exp and 16 years old) but there is one big difference:

- **<u>Stick stiffness</u>** (<u>nr 4 has 102 flex</u> and <u>nr 5 has 79 flex</u>)

Why I picked up these two participants, because they have the same anthropometric date and both are the same age, there is one difference and the most important – <u>*stick stiffness.*</u> Between these two players we can clearly see that the participant nr 4 has wrong stick stiffness (102 flex). The puck velocity of the participant nr4 wrist shot is **23 km/h** weaker then the participant nr 5 (stick stiffnes-79 flex).

Applying those different wrist shooting tests, we can clearly see that the results increased significantly. The lowest difference was between (test II) two legs wrist shot stationary and (test III) one leg wrist shot skating (<0.6 km/h). Between those two tests (II and III) there is not a big difference in puck velocity but comparing two different shots it is a huge difference. The regular two legs wrist shot in stationary position is not that much weaker than one leg wrist

shot in skating. So one shot was made from stationary position and other was made from speed and difference of velocity of the puck was only (<0.6 km/h).

The results showing that speed of the puck in two legs wrist shot is higher than in one leg wrist shot, even the median statistic shows equal results (89.5km/h and 89.5km/h) from skating, but still it is a difference in average (86.6km/h and 89.9km/h):

1) Stationary position	One leg wrist shot	Two legs wrist shot
	Min 72 (km/h)	Min 76 (km/h)
	Max 93 (km/h)	Max 102 (km/h)
	Median 80.5 (km/h)	Median 83.5 (km/h)
2) From skating	One leg wrist shot	Two legs wrist shot
	Min 73 (km/h)	Min 77 (km/h)
	Max 94 (km/h)	Max 108 (km/h)
	Median 89.5 (km/h)	Median 89.5 (km/h)

During the test it was defined that two legs wrist shot is stronger and faster as a wrist shot comparing with one leg wrist shot. In junior level this shot is more effective than quick release because still not enough strength and power in the shot.

7. Discussion

An increase in puck speed was observed when the legs position and shooting type was changed. Puck speed was affected not only by legs position but with type of the stick (flex) and the individual characteristics of the participant as well. The older age participants with bigger anthropometric data showed better results in speed of the puck, then the younger age participants with smaller anthropometric data.

All the participants were selected from several age groups and their skill level was significantly different. From obtained information about their background all the participants had trained at least the last two years with the Gota Traneberg club. I think during these tests not all the players showed their best results, for some of them this was a challenging procedure because they wanted to do their best but missed the net frequently because of their nervousness. These could be because of required attention from player during test procedure and his ability to focus on the task. One particular player overcame these issues and became a good example for other players in the club. The most significant result indicates two players compared to other.

The talent findings resulted the player's performance positively in shooting test but my opinion that some of them (participant nr. 6) weren't able to reach their optimal performance giving a chance to demonstrate the ability for other less talented players. The majority of the players increased the speed of the puck significantly but just from stationary position and skating position without significant speed difference between two legs wrist shot and one leg wrist shot.

The stick flex discovered information gives something that should be very considered in the teams/clubs. Most of the coaches don't even know what kind of flex their players are have and even the professional coaches probably does not have that kind of information either. There no information but might be an option, that the players cut their sticks and that give them few extra flex too.

My opinion scarcity of high level coaches and attention to the player individually from the coaches it is real factor, affecting the present results of the athlete's ability to reach the highest standard of their performance. This is probably the biggest reason why they performed not so well. Another reason, lack of practices because they playing in division I and II in Sweden and 2 practices per week is way to less to become a successful or professional player.

I think that the findings of the study presenting the most of the player's influence of wrist shot performance habits – one leg position in wrist shot. Probably is because of most visible in now day's ice hockey, and one of the quickest shot. The results showing that one leg wrist shot results are not significantly from two legs wrist shot and they using more often that type of the shot then two legs wrist shot.

The findings have many limitations. The researches were made in one local club. It is unclear of what kind of coaching background the players had when they were 10-13 years old. I think that majority of the players did not spend extra time for practice wrist shooting technique except the two players which showed the best results.

The club is playing not in the highest level. Comparing to other club players, elite level players, and the results might be very different from present.

Another very important aspect is the sticks and age groups because some of the players playing with way to stiff sticks and this way are leading the player in poorer performance.

My opinion the most important in junior level is that the player will learn proper technique of regular shot first and work on those shooting skills.

7.1. Recommendations for further researches

Future studies should investigate more equal age group and maybe two different sticks, for example: 1) 85 flex; 2) 100 flex and those sticks should be used for all players in order to get better results. The players should be in better physical shape, playing higher level. Their frequency of practices should be more than 2 practices per week.

The coaches of athletes should be more professional, to have the development programs. Coaches should use a practice data log to indicate how much the team practices certain drills and what they are improving or not.

Adding some kind of micro cycle (couple of week or one month) practices related to the shooting after the season. Run the test before the micro cycle and after in order to get not only results in puck velocity but the potential in shooting too.

8. Summary and Conclusions

My opinion the current results demonstrate that most of the players have been poorly paying attention in each practice and they jumped over the period of time when they were supposed to form a good shooting habit. However in their age still it's possible to break the wrong shooting habits in order become a successful player and professional player and to get much better scoring results. Also this is good information for coaches and players in the club to pay more attention in the future to succeed.

However the results show that shooting performance was improved by adjustment of legs position in stationary position and skating position too. Results also shows that the players practicing more frequent shooting stronger than players practicing 2-3 times per week.

The differences in conditions were not considered when the anthropometric date, age, experience in ice hockey and stick stiffness and frequencies of practices was explained.

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Appendix 1. **QUESTIONNAIRE**

Name/ Last name: …….

Your age: …….

Club name: …….

Your weight (kg): …….

Your height (m): …….

How many times you practicing per week? …….

In which division you playing? …….

Hockey experience (years): …….

What kind of stick stiffness you have? ……

Date: …….. **Sign:** ……..