

Technique, Level 100

By Peter Vordenberg, U.S. Ski Team Head Coach

Technique is the tool you use to apply your fitness to the sport. Technique is the screwdriver, fitness is what you use to turn the screwdriver, ski racing is the job you are trying to accomplish. With technique training you are simply trying to develop a good tool to help you get the job done. But fitness comes first. If you are fit enough you can drive the screw into the board with no screwdriver at all. There are many examples of skiers with inefficient technique winning even World Cup ski races – in other words skiers, who can drive the screw with no screwdriver. They do this with fitness. All technique work must be done in conjunction with and as an addition to preparation aimed at aerobic, anaerobic or strength oriented training. Do not mistake having a nice tool chest with being a good carpenter.

The following technique essays, based on the U.S. Ski Team's technique CD, teach technique methodically by first demonstrating body position, followed by timing, and concluding with the addition of power. Each chapter wraps up with a list of pertinent drills that a coach can bring with them to the pavement or snow.

Diagonal Stride

Diagonal Stride is the first gear in the classical transmission. It is used when climbing steeper hills where double poling or kick double pole will only bog the engine down.

Introduction

There are several important factors that play a key role in properly executing diagonal stride. To make the discussion easier they have been broken down into body position, timing and power. Each of these components play an integral part in executing the stride successfully. It is important that the athlete perfect each component to be successful.

Body Position

Body position in all sport is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason body position in diagonal stride is similar to other ski techniques as well as to other sports.

- **Feet:** Center the weight across the ball of the foot. If the weight is too far forward onto the toes it will be hard to apply enough force through the kick. If it is too far back it will be hard to apply force quickly enough to be powerful. The skier's weight will shift toward the whole foot in the glide

phase of this technique but will quickly shift back to the ball of the foot for the kick. Body position drills should focus on keeping the weight on the ball of the foot.

- **Ankles:** The bend in the ankles is vital to directing the power in such a way that the skier is propelled forward down the trail and not up in the air. The degree bend at the ankle is dependent primarily on terrain - the steeper the terrain the more acute the angle at the ankle. Also, the more force the skier is attempting to deliver the deeper the angle will be.
- **Knees:** The angle at the ankle must be closely mimicked by the angle at the knee in order to keep the skier's weight positioned over the feet where that force can be directed through the ski to the snow. Generally skiers struggle to get the proper angle at the ankle rather than at the knee. What results is a knee angle greater than the ankle angle, which places the skier's weight behind the feet. This slows the speed of the kick, loads a great deal of weight on the quadriceps, and diminishes the amount of force applied to the kick.
- **Hips:** The hips must be high and forward. When it comes to body position this is accomplished by having the skier's weight over the balls of the feet, maintaining the proper ankle and knee angle, keeping the upper body in a "C" position and by maintaining a quick kick. Look for the hips to remain high and forward through the entirety of the diagonal stride cycle.
- **Core/Back:** The upper-body, from tailbone to head, should form a soft "C" shape. Think Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural advice of your parents. This "C" position will help keep the hips over the feet, relax the lower back as well as position the muscles of the core to apply force to the poles. This "C" can be very shallow leaving the skier quite upright or rather pronounced putting the skier in an aggressive forward position. The depth of the "C" is also dependent upon terrain with most skiers adapting a more up-right shallow "C" position as the terrain becomes steeper. An "S" shape in the back is the most common core body position mistake and puts a lot of pressure on the lower back. This can also force the hips back. Another common mistake is to fold at the waist into an "r" position. This too forces the hips back and makes it hard to deliver power to the kicking ski.
- **Shoulders:** Shoulders should be rounded leaving the arms hanging free and loose in front of the body. Even skiers who ski in a very shallow, upright "C" position should have a forward attitude at the shoulder. This position allows for a smooth pendulum swing of the arms as well as a good position from which to apply both body weight and force to the poles.

- **Arms:** In the neutral or starting position the arms should hang loose from the shoulders. The angle of the arm at pole plant should enable the skier to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the arm will be much closer to 90 degrees in steeper terrain, and slightly straighter in more gradual terrain. At pole release the hand should be low. The follow through of the arm is dependent upon speed (and terrain). The faster the skier is moving the longer the follow through. The shoulders and hands should reach forward down the track in front of the skier rather than across the skier's body or out to the side.

Timing

In all techniques the whole body works together to transfer the skier's weight from ski to ski and down the track. Timing of the diagonal stride mimics that of a running stride. The skier's opposite arm and leg are forward together. In skiing the upper-body contributes forward momentum by applying power through the pole as the skier glides, plants, compresses and explodes forward off the kicking ski thus propelling the skier down the track. At the same time as the kicking ski and poling arm pass back behind the skier the opposite arm and leg swing forward (just like running) adding forward momentum to the propulsion down the track. This technique uses the same timing as running but has the added power of the upper-body, and the speed and efficiency of the ski gliding on snow.

The term "kick" is used to describe the forward propulsion of the skier from one ski to the next (as in a runner striding from one foot to the next). This term is misleading, as the skier does not actually kick backwards any more than a runner kicks backwards. This "kick" could better be described as a jump or the propulsive component of the stride, but the term "kick" is utterly entrenched and will do fine.

The "kick" of the diagonal stride can better be likened to the explosive jump of a long jumper than the foot strike of a runner. In either case imagine the jumper or runner attempting to kick the foot back at take off. In actuality the foot and leg is left behind the athlete in the follow through after the jump or foot strike. The same is true for the skier. In fact the skier's "kick" is similar to the jumper's jump in that the foot is planted on the ball of the foot. The athlete then compresses down on the planted foot, and explodes forward off the foot down the trail or, in the case of the jumper, through the air. The time the jumper spends in the air is the time the skier is gliding. The more powerful the jump the further the jumper sails through the air. The more powerful the "jump" for the skier the further the skier can glide. The major difference is the direction of this jump – the jumper must orient some power into the air while the skier is oriented entirely down the trail.

This jumping sequence is so linked as to be a single motion containing all the elements of glide, plant, compress, explode, glide. See more on timing under “Power”.

Power

Power results from force applied quickly. Power relies on being in a position that allows both the application of the skier’s strength and the application of that strength over a short period of time. The above description of body position aims to put the skier in that position. Timing allows power development while maintaining the forward momentum of the skier.

The effective, efficient and repetitive application of power to the skis and poles is the goal of learning proper technique – including body position and timing. Once the skier can grasp the idea of proper body position it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position and develop power from it. The practice of proper timing will help develop the speed of force application.

The job of the kick in diagonal stride is two-part. The first part is compressing the ski to the snow, which is vital to gaining the platform from which forward propulsion is performed. The second part is making that forward propulsion powerful enough to propel the skier further and faster than the competition.

A large part of this power comes from weight transfer. This could easily be put in the “body position” section. The entirety of the skier’s weight must be over the gliding / kicking ski for the skier to both glide with relaxed balance and apply maximal power to the kick. In fact the ski will carry 100% of the skier’s body weight in the glide and all the skier’s weight plus the force added by the kick itself during the kick phase.

In diagonal stride the speed of the kick is of primary importance to power development. This is because the skier must execute the kick fast enough in order to stop the ski in the snow without interrupting their forward momentum. In the short period of time that the ski can be stationary while the skier is still moving forward, that ski must be planted, flattened against the snow, and loaded with the force of the skier’s weight plus muscular strength (compressed) until the skier can finally explode forward off that foot onto the other ski. This entire sequence must be split-second fast – and that speed is the primary contribution to power in diagonal stride.

Power from the upper body is generated in a similarly quick application of force down onto the pole. The force is developed with a crunching motion of the core as well as the use of the lats and application of the upper body’s weight onto the poles. This motion actually takes place over a longer period of time than the kick

as the poling motion begins before the initiation of the kick. Never-the-less power is still developed by applying this force quickly. To enable this, the poling motion should not be overly drawn out. The forward swing of the other arm is simultaneous to the poling arm. It should be swung low, relaxed and directly down the track so its momentum can be best be utilized.

Drills

- **Hot Feet:** The goals of the Hot Feet Drill are to teach the skier about proper hip positioning, weight transfer and correct stride length in the technique of Diagonal Stride. To achieve these goals, a ten meter section of the track is marked on each end by a flag or a coach's pole. Be sure the terrain is steep enough to demand Diagonal Stride, yet gradual enough to support beginner skiers. Instruct the athletes to begin striding roughly 50 meters before the marked section begins. When they reach the marked section the skier runs on their skis from one marker to the next with quick but controlled tempo and no glide, and then skis out of the marked section with traditional diagonal stride for an additional 50 meters. The coaching point to look for in this drill is an improvement in hip positioning during the 10 meter hot-feet section, and within the final 50 meter section. The success of this drill is due to the mechanics of a normal running stride on dry land, where the hips are high and only one foot is on the ground at a time. With high hips, the skier's weight is over the ball of the foot, and is supported to a large extent by the near-vertical femur bone. From this position, the run, or quick falling forward from the ankles floats the skier from a good body position on one ski into a good body position on the other. Because the weight is falling forward from the ankles, the hips do not have the opportunity to sink back behind the heels. Ask the skier where they feel their weight. If it is over their heels, watch for sinking hips and a kick that is too long, or late. If the weight is over the ball of the foot during the kicking phase, expect to see good hip positioning. Finally, proper running technique emphasizes full weight shift from one foot to the next. Note that proper weight transfer should not be the result of the upper body tipping laterally from side to side, rather, the transfer happens subtly within the hips. This will ensure that the wax pocket is compressing firmly into the snow so that the ski does not slip backwards. This is a good way to teach transitions from gradual to steep terrain as well.
- **Minson's Last Dance:** The goal of Minson's Last Dance is to teach the skier about proper hip positioning and forward lean from the ankles within the Diagonal Stride technique. In order to accomplish this drill have the skier drop their poles and find a section of track that is flat or a gentle uphill grade. To emphasize the difference between high hips, and hips that are sitting back, have the skier begin by standing still in the tracks,

posed in a poor hip position. The skier can place their hands on their hips to gain a better feel of the proper positioning. Slowly, the skier should bring their hips higher and further forward so the body weight shifts from the heels to the ball of the foot. As this happens the skier will begin to fall forward from the ankles. With high hips, begin the forward propulsion by catching the body weight with one foot. During this catch the hips remain high and avoid sinking down and back. Continue to fuel forward propulsion by falling forward from the ankles. Left right left right. Begin with a shuffle and no glide. Every five meters, add several inches of glide over the course of 50 – 100 meters until the skier has reached a full stride. Note that the length of the glide is not determined by the size of the step, but by the force with which that ski is driven forward. Coaches can observe the entire progression and look for a point in which the stride length becomes too long so that the good body position is overwhelmed by an over-stride resulting in sinking hips. If this occurs, try cutting the stride length down by several inches, or use the Hot Feet Drill. During Minson's Last Dance, the skier should also see to it that weight is fully transferred before kicking. A good way to see this is that there should be only one foot on the ground at a time. With beginner skiers, the tendency is to stay safe and comfortable by keeping the weight in the middle. This will only weight both skis evenly with half of the body weight and will fail to compress the wax pocket. It is not always the coach that bombs the kick wax!

- **No Pole and One Ski Drills:** The goal of these balance drills is to stretch the skier's comfort zones by removing a stabilizing component from their skiing like poles or a ski in the technique of Diagonal Stride. The coaching points to look for in skiing with no poles are: a relaxed upper body with rounded shoulders, proper arm and hand swing that if holding a cup of water would throw the water down the track and not up, across the body, or out to the side, high hips, weight that is over the ball of the foot and not the heel, and full weight transfer from ski to ski. Also look for a snappy kick that sets the wax sharply down into the snow before exploding off of the ski, but do not mistake this movement for a full-body bounce. If the terrain being used is either fast or on a gradual down, see that the skier is kicking quickly enough so that the wax can grab purchase in the snow. This is good timing and quickness training. To progress within this drill, try holding the glide for several seconds before kicking. For a little extra fun and to take balance to the next level, ski down a gradual hill on only one ski. It might be a good idea to keep the other ski on so that if balance wavers and the foot touches down, there is not a yard sale of poles, hats, and sunglasses to clean up.

- **Skipping:** The goals of the skipping drill are to gain a better understanding of high hips, weight shift, balance, timing, and of a powerful kick in the technique of diagonal stride. To perform this drill, the skier might first want to practice skipping without skis on, so as to learn the proper timing of the drill. Proper timing in this drill involves completing each glide with a gentle and vertical hop or skip. As the skier comes down from the skip, the kick is initiated and the next glide phase begins. This drill accomplishes a few things. First, the skipping action insures that the hips are in a high and forward position. Additionally, the body weight that is driven down into the snow as a result of the skier coming down from the skip insures that the wax pocket is fully compressed into the snow for better kick. Remember, too, that more power not only means better kick, but longer glide as well. In the Diagonal Stride technique, full weight transfer over each kicking ski is imperative. This means 100% of the body weight is over the kicking ski, minus what is suspended by the pole. This weight is transferred into power when the kick initiates where a small amount of the power closes the wax pocket shut on the snow, and the majority kicks the skier forwards and down the track.

Conclusion

Proper body position enables proper timing—both of which enable effective, efficient application of power.

Double pole

Double pole is the third gear in the classical transmission. It is used on gradual uphill and downhill terrain where kick double pole and diagonal stride will over-rev the engine.

Introduction

There are several important factors that play a key role in properly executing double pole. To make the discussion easier they have been broken down into body position, timing and power. Each of these components plays an integral part in executing the technique successfully. It is important that the athlete perfect each component to be successful.

Body Position

Body position in all sport is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason body position in double pole is similar to other ski techniques as well as other sports.

- **Feet:** Center the weight across the ball of the foot. If the weight is too far forward onto the toes the front of the ski's kick zone will dig into the snow.

If it is too far back it will be hard to apply enough force to the poles to be powerful. In double pole the weight will shift to the whole foot and even to the rear of the foot for the glide portion of the technique, but will shift back to the ball of the foot for the poling portion of the technique. Though time spent on the balls of the feet will be short, body position drills should focus on keeping the weight on the ball of the foot as this is the power-position for this technique.

- **Ankles:** The bend in the ankles is vital to directing the power in such a way that the skier is propelled forward down the trail and not up in the air. The degree bend at the ankle is dependent primarily on terrain - the steeper the terrain the deeper the angle at the ankle. Also the more forward the skier can get in the power position the greater the bend at the ankle will be – until the entire rear of the boot lifts from the ski.
- **Knees:** The angle at the knee must be quite shallow as compared to the ankle angle. The legs do contribute to the power applied to the poles, but this contribution needs to be balanced with the requirement expected from the legs in diagonal stride. So limit the use of the legs to a slight bend at the knee. When the knees bend deeply, there is a lot of body weight to lift when returning to a proper starting position.
- **Hips:** The hips must be high and forward. When it comes to body position this is accomplished by having the skier's weight over or in front of the balls of the feet, maintaining the proper ankle angle, keeping the upper body in a "C" position and by seeking a high position with the hands and a forward position with the elbows. Look for the hips to remain high and forward through the entirety of the double pole cycle – even at the end of the cycle when the poling motion is finished.
- **Core/Back:** The upper-body, from tailbone to head, should form a soft "C" shape. Think Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural advice of your parents. This "C" position will help keep the hips over the feet, relax the lower back as well as position the muscles of the core to apply force to the poles. This "C" can be very shallow leaving the skier quite upright or rather pronounced putting the skier in an aggressive forward position. Seek to stay in a more upright position where the hands are high and the body is working from a high position to a middle position rather than from a middle position to a low position. A common mistake is to fold at the waist into an "r" position. This forces the hips back and slows the cycle time of the double pole as well as steals power from the optimal use of the core muscles.

- **Shoulders:** Shoulders should be rounded leaving the arms hanging free and loose in front of the body. This position is ideal for applying both body weight and force to the poles.
- **Arms:** In the neutral or starting position the arms should hang loose from the shoulders. The angle of the arms at pole plant should enable the skier to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the arm will often be close to or less than 90 degrees. This is terrain dependent, with steeper terrain demanding a sharper angle. At pole release the hands should be low. The follow through of the arms is dependent upon speed (and terrain). The faster the skier is moving the longer the follow through can be – but doesn't necessarily need to be. Keep the follow through short enough to help keep the hips high and to return to the poling position again as quickly as the terrain dictates.

Timing

In double pole the upper-body is used to apply power onto the poles to propel the skier down the trail. The key to double pole timing is in the application of power to the poles. With the arms and body in the proper position the body weight falls on top of the poles as the core contracts, thus crunching down powerfully on top of the poles. The back and arms simultaneously push on the poles. This application of force must be quick and timing tight in order to be maximally powerful. The return of the upper body to a high start position is also important to this technique. The forward arm swing must be dynamic and in synchrony with the return of the upper-body to a high position in order to gain forward momentum and in order to return to a high position quickly and smoothly. See more on timing under "Power".

Power

Power results from force applied quickly. Power relies on being in a position that allows both the application of the skier's strength and the application of that strength over a short period of time. The above description of body position aims to put the skier in that position. Timing allows power development while maintaining the forward momentum of the skier.

The effective, efficient and repetitive application of power to the poles is the goal of learning proper technique – including body position and timing. Once the skier can grasp the idea of proper body position it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position and develop power from it. The practice of proper timing will help develop the speed of force application.

A good mantra for double poling is “high hands.” The power position in double pole is the hands high, arms at 90 or less degrees, poles against or parallel with the forearms, and body leaning from the ankles dramatically forward. From this start position the body’s weight will crash down onto the poles, the core will crunch and the arms and back will contribute force simultaneously. The poles will connect with the snow delivering all this power directly to the snow. With the arms held in tight there will be minimal power lost to a collapse of the arms, and the forward movement of the skier will push the tips of the poles back and the handles down translating power to forward movement.

Hands that start low steal most of the body weight as well as the ability of the core muscles to do their job at the start of the poling motion. At the same time the skier will not be able to seek as great a forward lean. While the pole angle more immediately translates to forward motion (baskets planted further back) there cannot be as much force applied to the poles. This force is applied late in the cycle and leaves the skier in a very low finishing position.

It should be noted that the arms can be planted at straighter than 90 degrees. In this case, however, some of the applied force will be given away as the arms collapse to a structurally strong position. The force in this case cannot be applied as quickly, thereby resulting in less power. Cycle time will also increase making it difficult to maintain momentum as the terrain goes uphill.

Drills

- **Locked ‘n Loaded:** The goal of the Locked ‘n Loaded Drill is to teach the athlete about proper initiation of power, the role of the core, and the importance of the body weight falling forward from the ankles in the double pole technique. These goals are accomplished by beginning the cycle with high hips and hands. From this position, the skier crashes onto the poles with a strong abdominal crunch to initiate the power. To isolate this impact, have the skier envision that their upper body is fixed in cement. The only flex point is in the core and in a slight bend in the knees. By eliminating the full release of the poles as typically utilized in the Double Pole technique, the skier now must rely on only the force of the impact enabled by the forward body position and the strength of the core crunching onto the poles to generate forward propulsion. Because the upper body is locked, the retrieval of the poles and the lifting of the core to the high position are simultaneous. This generates upward and forward momentum. The upward momentum will pull the hips forward so that the upper body and legs are in line and ready to fire. The forward momentum causes the body weight to shift from the mid-foot to the ball of the foot, thereby initiating forward lean from the ankles. With the assistance of body weight now involved in the compression, the crashing onto the poles is all the more effective.

- **Standing Broad Jump:** The goal of the Standing Broad Jump Drill is to teach the athlete about the importance of proper timing in the retrieval of the poles back to the high position in the double pole technique. To achieve this goal, have the skier take off their skis or roller skis and poles and visualize a standing broad jump. Now have the skier perform two jumps. The first jump retrieves the hands to a high and forward position after the feet have landed. The second jump retrieves the hands as the jump happens, or rather, simultaneously with the lifting of the upper body—just like a standing broad jump. Compare the two distances. The latter of the two jumps will be longer and the movements more efficient. Proper timing of hand retrieval in double poling can be likened to the form used in a proper standing broad jump. The snappy forward and upward momentum generated by returning the hands and lifting the upper body to the high position in unison does several things: First, the body stretches out like an elastic band, pulling the hips forward and the hands high so that the skier is ready to perform a powerful compression. If the hips do not come completely forward, the spring that is the body will not be fully stretched and ready to snap effectively into the power phase. Additionally, the momentum generated in a timely and snappy return will cause the skier to fall forward from the ankles. With the assistance of body weight now involved in the compression, the crashing onto the poles is all the more effective.
- **Bathroom Scale:** The goal of the Bathroom Scale Drill is to demonstrate the importance of proper upper body position in the double pole technique and how it pertains to power application. This drill is named as such because a skier can perform the exercise without the assistance of a coach, simply by using a scale. Be sure to put a board down so carbide tips do not get the skier in trouble, and so that the poling technique is not hampered by a narrow scale. To achieve the goal of this workout, the athlete extends their arms straight out in front of them with little or no bend at the elbow. The coach supports the hands, or the scale supports the tips, as the athlete drives downward in a double poling motion. Now adjust the hands and arms of the athlete to a proper double poling start position. That is, hands are high with the pinky finger roughly even with the eyes, and also shoulder width apart. Elbows are bent at approximately 90 degrees and shifted comfortably away from the centerline of the body. This time the coach supports the elbows or holds the skier's wrists as they drive the upper body down into a double poling motion. The scale can be used in the same manner as earlier. The difference in power will be overwhelming as the latter drill is far more forceful. The factors at play here have to do with the structure of the hands and arms. High hands with elbows bent at 90 degrees allow for a

strong support system, and body weight can momentarily hang on the poles for more power, whereas arms straight out in front eliminate the role of body weight in the poling motion. In addition, elbows shifted comfortably away from the centerline activate and add strong Latisimus Dorsi muscles to the poling motion. Another way to look at this positioning when out double poling is to extend the hands and arms straight out in front of the body. Instead of bringing the hands in toward the body, bring the body toward the hands and into a strong position by falling from the ankles. This is your forward lean. Now the skier can apply the Bathroom Scale drill to snow.

Conclusion

Proper body position enables proper timing—both of which enable effective, efficient application of power.

Kick Double Pole

Kick double pole is the second gear in the classical transmission. It is used on gradual-uphill terrain when double pole would bog the engine down or diagonal stride would over-rev the engine.

Introduction

There are several important factors that play a key role in properly executing kick double pole. To make the discussion easier they have been broken down into body position, timing and power. Each of these components plays an integral part in executing the technique successfully. It is important that the athlete perfect each component to be successful.

Body Position

Body position in all sport is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason body position in kick double pole is similar in other ski techniques as well as other sports.

- **Feet:** Center the weight across the ball of the foot. If the weight is too far forward onto the toes it will be hard to apply enough force through the kick. If it is too far back it will be hard to apply force quickly enough to be powerful. In kick double pole the weight will shift to the whole foot after the double pole portion of the technique, but will shift back to the ball of the foot for the kick. Body position drills should focus on keeping the weight on the ball of the foot.
- **Ankles:** The bend in the ankles is vital to directing the power in such a way that the skier is propelled forward down the trail and not up in the air.

The degree bend at the ankle is dependent primarily on terrain - the steeper the terrain the deeper the angle at the ankle. Also, the more force the skier is attempting to deliver the deeper the angle will be.

- **Knees:** The angle at the ankle must be closely mimicked by the angle at the knee in order to keep the skier's weight positioned over the feet where the force can be directed through the ski to the snow. Generally skiers struggle to get the proper angle at the ankle rather than at the knee. What results is a knee angle greater than the ankle angle, which places the skier's weight behind the feet. This slows the speed of the kick, loads a great deal of weight on the quadriceps, and diminishes the amount of force applied to the kick.
- **Hips:** The hips must be high and forward. When it comes to body position this is accomplished by having the skier's weight over the balls of the feet, maintaining the proper ankle and knee angle, keeping the upper body in a "C" position and by maintaining a quick kick. Look for the hips to remain high and forward through the entirety of the double pole kick cycle – even after the double pole portion of the technique.
- **Core/Back:** The upper-body, from tailbone to head, should form a soft "C" shape. Think Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural advice of your parents. This "C" position will help keep the hips over the feet, relax the lower back as well as position the muscles of the core to apply force to the poles. This "C" should be very shallow leaving the skier quite upright or rather pronounced, thereby putting them in an aggressive forward position. The depth of the "C" is also dependent upon terrain with most skiers adapting to a more up-right shallow "C" position as the terrain becomes steeper.

An "S" shape in the back is the most common core body position mistake and puts a lot of pressure on the lower back as well as forces the hips back. Another common mistake is to fold at the waist into an "r" position. This too forces the hips back and makes it hard to deliver power to the kicking ski or onto the poles in the double pole.

- **Shoulders:** Shoulders should be rounded leaving the arms hanging free and loose in front of the body. Even skiers who ski in a very shallow, upright "C" position should have a forward attitude at the shoulder. This position allows for a smooth pendulum swing of the arms as well as a good position from which to apply both body weight and force to the poles.
- **Arms:** In the neutral or starting position the arms should hang loose from the shoulders. The angle of the arms at pole plant should enable the skier

to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the arm will be close to or greater than 90 degrees. At pole release the hands should be low. The follow through of the arm is dependent upon speed (and terrain). The faster the skier is moving the longer the follow through. Keep the follow through short to help keep the hips high at the end of the double pole.

Timing

In all techniques the whole body works together to transfer the skier's weight from ski to ski and down the track. The kick double pole begins with a double pole. This leaves the arms slightly behind the skier, the upper body in a relatively low position and the skier's weight spread evenly over both skis. The skier must then transfer all their weight to the kicking ski, plant, compress and explode forward off the kicking ski (as in diagonal stride) in absolute synchrony with the forward swing of the arms, the return of the upper body back to a high double pole position, and the forward swing of the back leg. The opposite leg becomes the kicking leg in the next cycle.

Please see the Diagonal Stride PDF for an explanation of the term "kick" and the actual timing of the kick. In kick double pole the kick is very similar to that of the diagonal stride kick. In the same way the "kick" can be likened to the explosive jump of a long jumper's jump in that the weight is planted on the ball of the foot, the athlete compresses down on the planted foot, and then explodes forward off the foot down the trail or, in the case of the jumper, through the air. In both diagonal stride and kick double pole the "kick" propels the skier down the track and onto the other ski and into an extended position. In kick double pole the skier is now gliding on one ski with both arms forward in a double pole position. The skier applies a double pole similar to a normal double pole. Please see the Double Pole PDF for further explanation of this portion of the technique. See more on timing under "Power".

Power

Power results from force applied quickly. Power relies on being in a position that allows both the application of the skier's strength and the application of that strength over a short period of time. The above description of body position aims to put the skier in that position. Timing allows power development while maintaining the forward momentum of the skier. The effective, efficient and repetitive application of power to the skis and poles is the goal of learning proper technique – including body position and timing. Once the skier can grasp the idea of proper body position it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position and develop power from it. The practice of proper timing will help develop the speed of force application.

The job of the kick in kick double pole is the same as in diagonal stride. (Please see the Diagonal Stride PDF.) Just as in diagonal stride the speed of the kick is of primary importance to power development. At the same time weight shift is just as vital. Many people attempt to kick with their weight spread evenly over both feet in the double pole kick. All the skier's weight must be on the kicking ski in order to apply maximal power to that ski. In fact the ski will receive 100% of the skier's body weight plus the force added by the kick itself.

In kick double pole the arm swing forward must be as quick as the kick itself. This powerful forward swing will help gain forward momentum. This brings the skier into a double pole position. Please see the Double Pole PDF for an in depth explanation of the technique. In kick double pole the double pole will likely be notably shallower with less follow through and less upper body compression than in regular double pole. This is due to the technique being carried out on generally steeper terrain and the need for the hips to stay high for the kick portion of the technique.

Drills

- **Locked 'n Loaded:** The goal of the Locked 'n Loaded Drill is to teach the athlete about proper initiation of upper body power, the role of the core, the importance of the body weight falling forward from the ankles, and finally, proper initiation of power in the kick. These goals are accomplished by beginning the cycle with high hips and hands. From this position, the skier crashes onto the poles with a strong abdominal crunch to initiate the power. To isolate this impact, have the skier envision that their upper body is fixed in cement. The only flex point is in the core and in a slight bend in the knees. By eliminating the full release of the poles as typically utilized in the Double Pole technique, the skier now must rely on only the force of the impact and the strength of the core to generate forward propulsion. Because the upper body is locked, the retrieval of the poles and the lifting of the core to the high position are simultaneous. This generates forward momentum and causes the body weight to shift from the mid-foot to the ball of the foot, thereby initiating forward lean from the ankles. With the assistance of body weight now involved in the compression, the crashing onto the poles is all the more effective. Last but not least, lets take a look at the kick and link it to the retrieval of the upper body and poles. With a snappy retrieval, the kick also will be snappy, powerful, and effective. What occurs in the upper body is reflected in the lower body, and vice versa. Be sure to weight the kicking ski with 100% of the body weight as the kick occurs.
- **Ankle Float:** The goal of the Ankle Float Drill is to teach the athlete about proper weight transfer, a powerful kick, and good balance that are all required for effective kick double poling. To accomplish these goals the

skier must recognize that to close the wax pocket firmly onto the snow, approximately 100% of the body weight needs to be applied to each kick in addition to the weight generated by the force of the kick itself.. This weight transfer does not happen by tipping the upper body over the ski. Rather, the weight is shifted through a subtle hip movement from right to left, left to right. To execute this drill properly, abbreviate the return of the leg after it has completed its kicking motion. Leave the ski suspended briefly behind the gliding leg, or floating lightly in the track if proper balance is a drill prohibitive challenge. In either case, there is little or no weight riding on the returning ski, and 100% of the body weight is applied to the kick, thereby setting the wax firmly in the snow and finding a solid purchase so as to propel the skier down the track. Again, the motion of the kick is a quick but powerful pop down into the snow that grabs the frozen crystals and sets the wax, thereby allowing a powerful bound forward onto the glide ski. If proper balance is a challenge yet after lowering the height of the suspended ski, try the drill in slower snow or slightly steeper terrain.

Conclusion

Proper body position enables proper timing—both of which enable effective, efficient application of power.

V1

V1 is the first gear in the skating transmission. It is used when climbing steeper hills where V2 or V2 alternate will only bog the engine down. All skate techniques have small variations that make them more versatile over different terrain. Where this is especially true for V2 and V2 alternate, it is not as true for V1 which is an uphill technique. As skiers become stronger it is reserved for only very steep up hills.

Introduction

There are several important factors that play a key role in properly executing the V1 technique. To make the discussion easier they have been broken down into body position, timing and power. Each of these components plays an integral part in executing the technique successfully. It is important that the athlete perfect each component to be successful.

Body Position

Body position in all sport is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason body position in V1 is similar to other ski techniques as well as other sports.

- Feet: Center the weight across the whole foot, with slightly more than half of the weight toward the ball of the foot. If the weight is too far forward onto the toes it will dig the front of the ski into the snow and plow. If it is too far back it will force the hips back and make the skier carry a lot of weight on the quadriceps. The skier's weight will shift toward the forefoot as the ski is set down and will quickly shift back across the whole foot for the majority of the push phase of the skate. At the end of the push the weight will again tend toward the front of the foot but most of the power comes from skating off the whole foot.
- Ankles: The bend in the ankles is vital to positioning the skier in a powerful pushing position and into a position that prevents the ski from stalling out as it moves across the snow. The angle at the ankle is dependent primarily on terrain - the steeper the terrain the more acute the angle at the ankle. Also, the more force the skier is attempting to deliver the deeper the angle will be.
- Knees: The angle at the ankle must be accompanied by an aggressive angle behind the knee in order to keep the skier's weight positioned over the feet where that force can be directed through the ski to the snow. Generally skiers struggle to get the proper angle at the ankle rather than at the knee. What results is a knee angle smaller than the ankle angle, which places the skier's weight behind the feet. This loads a great deal of weight on the quadriceps, and diminishes the amount of force applied to the push. The skier can think of driving the knee forward or pressing with the knee to accomplish this position.
- Hips: The hips must be over the feet. When it comes to body position this is accomplished with knee drive, maintaining the proper ankle and knee angle, and keeping the upper body in a "C" position. High hips position the femur bone nearly vertical, thereby supporting body weight on bone structure instead of on the musculature.
- Core/Back: The upper-body, from tailbone to head, should form a soft "C" shape. Think Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural advice of your parents. This "C" position will help keep the hips over the feet, relax the lower back as well as position the muscles of the core to apply force to the poles. This "C" can be either very shallow and leaving the skier upright, or rather pronounced putting the skier in an aggressive forward position. The depth of the "C" is dependent upon terrain. Most skiers will adapt a more upright, shallow "C" position as the terrain becomes steeper. Folding at the

waist into an “r” position is the most common error skiers make. This forces the hips back and generally increases the angle at the ankle.

- **Shoulders:** Shoulders should be rounded leaving the arms hanging free and loose in front of the body. Even skiers who ski in a very shallow, upright “C” position should have a forward attitude at the shoulder. This position allows for a smooth pendulum swing of the arms as well as a good position from which to apply both body weight and force to the poles.
- **Arms:** In the neutral or starting position the arms should hang loose from the shoulders. The angle of the arms at pole plant should enable the skier to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the hang arm will be no greater than 90 degrees at pole plant. The push arm should be slightly lower and more forward, placed in a similar position to diagonal stride. The angle is much bigger. At pole release the hands should be low. The follow through of the arms is dependent upon speed and terrain. The faster the skier is moving the longer the follow through. Because V1 is used in steep terrain it is most likely that follow through will be short and hand return immediate.

Remember that the V1 technique uses an offset position of the hands. The high hand belongs to what’s called the hang arm. The hang arm delivers most the poling power. The hand should be close to the head at the initiation of the poling motion. The other hand is planted lower. Be watchful that this hand does not creep too far across the skier’s body.

Timing

In all techniques the whole body works together to transfer the skier’s weight from ski to ski and down the track. The V1 technique is described in terms of the hang arm. If it is the skier’s left hand that is placed high and next to the head at the start of the poling motion, the hang side, also called poling side is the left side.

On the poling-side the entire upper body and poling-side leg push simultaneously down and over to transfer weight to the non-poling side. There is little to no time spent inactively gliding in the V1 technique. As soon as the skier’s weight is shifted onto the non-poling side the arms begin to swing back up and forward as the skier begins the push-skate back onto the poling side. When the skier transfers weight back to the poling side the poles and poling-side ski meet the snow simultaneously. While for some skiers the poles plant a little earlier than the ski, and for others the opposite is true, for most it is simultaneous. In all cases the push from each leg is as equal, smooth and powerful as possible and

the use of the upper-body is dynamic through a relatively shallow compression and short follow-through.

Power

Power results from force applied quickly. Power relies on being in a position that allows both the application of a skier's strength and the application of that strength over a short period of time. The above description of body position aims to put the skier in that position. Timing allows power development while maintaining the forward momentum of the skier.

The effective, efficient and repetitive application of power to the skis and poles is the goal of learning proper technique – including body position and timing. Once the skier can grasp the idea of proper body position it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position and develop power from it. The practice of proper timing will help develop the speed of force application.

Power is developed on the poles through the application of body weight to the poles. This happens through the dynamic use of core, back and to a lesser degree the arms themselves. A lot of power comes from the upper body in the V1 technique. Some skiers rely more on the upper body than others. A common mistake is to let the use of the legs suffer by focusing too much on using the upper body. Ideally, as is the case with all techniques, the whole body not only works together, but the work of one complements and aids the work of the other.

Power to the skis is achieved through a push position similar to that used by speed skaters. Whereas in the classical diagonal stride the ski must stop for the kick, in skating the skis must never stop. The biggest error in V1 power application is a weak-side – strong-side approach. This means relying on the poling side to build momentum or power and using the non-poling side as a recovery side. This results in a loss of momentum on the recovery side. It is much more efficient to maintain momentum than to build it, lose it, and build it again. This is similar to what cyclists call peddling in squares – where you only apply force on the down stroke. The best cyclists apply force around the whole circle resulting in smooth continuous power and often (as in the example of Lance Armstrong) at a higher cadence.

While the cyclist peddling in squares can still rely on the downward bound leg to apply force while the upward bound leg “rests” the skier has nothing to maintain momentum with while on the “recovery side”. Generally the weak-side approach means the skier will stand up or peg-leg on the recovery side leg. The weak-side ski decelerates as the skier stands up on it. To correct this the skier must focus on driving with the non-poling side knee as soon as that ski hits the snow and until weight is transferred back to the poling side. The skier may look as this

concept as a volley of the body weight back and forth, like a tennis ball, in which the legs are the rackets. Being dynamic with the return of the arms to the poling side and synchronizing that arm swing with the skate will help maintain momentum on the non- poling side.

A large part of power development comes from weight transfer. This could easily be put in the “body position” section. Optimally the entirety of the skier’s weight must be over the gliding / pushing ski for the skier to both glide with relaxed balance and apply maximal power to the skate. In skating, weight transfer is achieved through the shifting of the hips from side to side. Many focus exclusively on shifting the weight with the upper body. This can result in a tipping or twisting of the upper body but no real weight transfer. The body’s mass is best moved by shifting the hips.

In all skate techniques complete weight shift (where the skier is actually directly on top of the ski at the beginning of the push phase) can compete with the need to shift weight more quickly to avoid bogging down on steeper terrain. This is especially true in the V1 technique because it is used almost exclusively in steep terrain. One way to accomplish both good weight transfer and maintain momentum is to keep the feet in a wide position (never letting the feet come close together). When this is the case the skier’s body will stay inside the feet and the skier will never be directly on top of the ski. Weight shift will still be effective however, so long as the hips are shifting from side to side and pushing against one ski and then the other.

Drills

- **Four Square:** The goals of the Four Square drill are to teach the skier about proper ski placement within the V1 technique, and to demonstrate why improper placement is inefficient. To perform this drill, have the skier take off their skis, and lay their poles in the snow, one on top of the other at 90 degree angles. Four similar square boxes are the result. Stand with one foot in the center of each of what are determined to be the two rear boxes. With feet planted in a V, similar to the angle used in V1, and with body weight evenly distributed over each foot, shift the body weight from one box to the other without the boots leaving the snow. With the body weight properly spread over the feet and sufficient ankle flexion resulting from pressing the knees forward, the hips remain in a strong and forward position. If the angle formed between the shin and the foot remains less than 90 degrees, the hips will stay in a strong position as the skier shifts their body weight from the left to right, right to left. Repeat this weight transfer with proper body position for several minutes to imprint the feeling. What is happening is a symmetrical kicking motion from side to side, something that is difficult to achieve in the asymmetrical technique of V1. Now, take the left foot and move it forward one box, as if taking a big

step up the hill in V1. Notice that the weight is suddenly compromised in the center of both skis, and in order to bring the body weight up and over that left foot to return to a good forward hip position, the hamstring and quadriceps leg muscles must do some serious lifting. Switch back and forth between the two ways of moving within the Four Square and decide which method is better— Side to side kicking, or stepping up the hill. In V1, there is a common misconception that taking a big step up the hill will aid the skier in covering more ground. This is not the case and is in fact very strenuous. Instead, employ a side-to-side skating push that maintains good hip positioning through the entire motion. Practice skating with no poles and emphasize this side-to-side movement. Ultimately, an even, side-to-side kick is the goal in V1.

- **Hybrid:** The goal of the Hybrid Drill is to develop a symmetrical kick from right to left, left to right within the technique of V1 so that the skier can get better mileage. Note that it is a common tendency for skiers to employ an effective kick that transfers the body weight to the other ski with the poling side leg, only to falter on the non-poling side by standing up and falling back over to the poling side, skipping the kick entirely. To combat this standing up motion, point out to the skier that the motion of standing up on that ski is very similar to a proper kick, but in the wrong direction. Focus on side to side kicking, as demonstrated by the Four Square drill, such that body weight is transferred back and forth—not unlike a tennis ball being volleyed back and forth across the net. Now to perform this drill, begin skating up a gradual incline with your poles on—but without planting them in the ground. Symmetrical kicking is much easier without the incorporation of a pole plant. Skate 3 times on each leg before involving the poles. Using the poles, skate 3 times on each leg again. The skier should not feel a change in symmetry in the legs as the asymmetrical poling motion is added. Switch back and forth between the two methods until symmetrical kicking, also called even kicking is mastered. For skiers new to this drill and concept, it should be noted that symmetrical side-to-side kicking with both legs is a rather advanced style of V1.
- **Minson's Last Dance:** The goals of Minson's Last Dance are to teach the skier about proper hip positioning and forward lean from the ankles within the V1 technique. In order to accomplish these goals have the skier drop their poles and find a section of corduroy that is flat or a gentle uphill grade. To emphasize the difference between forward hips and hips that are sitting back, have the skier begin by standing still and posed in a poor hip position, sitting back, with skis in a V. The skier can place their hands on their hips to gain a better feel of the proper positioning. From this poor position the skier should press forward with the knees bringing the hips forward over the feet. It is important that the knees press forward creating

a sharp ankle flexion. As this happens the skier will begin to fall forward from the ankles. With hips that are forward over the foot, begin the forward propulsion by catching the falling body-weight with one small skate step. In order to maintain proper body position, as the skier moves forward the step from ski-to-ski must be kept small and all attention must remain on the fall forward at the ankles. Left right left right. Begin with a short glide. If the skier is able to maintain a good position they can gradually add several inches of glide over the course of 50 meters until the skier has reached a full skate. The coaching points to watch for are complete weight transfer from left to right. With beginner skiers, the tendency is to stay safe and comfortable by keeping the weight in the middle. Also watch the hip and see that it remains over the mid section of the foot. If the hips fall behind the foot then the skier should press the knee further forward. Remember, it is the forward lean from the ankles within the V1 technique that drives forward propulsion.

- **Saddle Feet:** The goal of the Saddle Feet Drill is to train the skier to utilize even kicking from side-to-side as well as maintaining momentum by moving from skate-to-skate in the V1 technique. In order to accomplish these goals, the skier should drop their poles and find a gradual uphill. Poles can be added later. In an effort to skate evenly and maintain momentum the skier should experiment with two trials. In the first pass, have the skier skate up the gradual hill in V1 and bring their feet close together to the point that they are clicking their heels just prior to setting down the glide ski. Observe the skiers and be sure they are aware of how this feels. In the second pass instruct the skier to ski the same section but do not let the feet come close together at any time of the skate cycle. In this drill the height of the skier will affect how wide their stance should be, though somewhere between 1 ½ and 2 feet will suffice. In a race the terrain will dictate feet width – the steeper the hill the wider the feet will stay. That is, when the glide ski is set into the snow, the feet are 1 ½ to 2 feet apart. Compare the two passes. With narrow feet, weight transfer may seem to be simpler but in fact that is only because the feet come in under the skier rather than the skier getting over the foot. The difference is that when the foot is directly under the skier there is no leverage to apply force to the ski. Even if the leg is loaded and in a strong position any kicking motion will only push the skier straight up. With saddle feet the ski is set down in a position that immediately allows the skier to laterally kick their weight over to the other ski. It should be emphasized again that by using the saddle feet stance, weight transfer becomes a matter of moving the hips from side-to-side rather than leaving the hips in the middle and attempting to bring the feet in under them. At first many beginner skiers say this feels “funny – but that it is easier to get up the hill.”
- **No Pole Drills:** The No Pole Drills are actually a bit of a misnomer as the skier will use the poles as indicators of whether or not they are twisting in the core or tipping over in the upper body in the V1 technique. Let's first take a look at holding the poles horizontally in front of the skier, perpendicular to the direction of travel. The goal is to skate up a section of trail without twisting the upper body. A twist will quickly be evident if the poles stray from their position of being perpendicular to the direction of travel. If a twist is detected, it is important to quiet the excess movement in the upper body as the important motion of the upper body movement in the V1 technique is a quick and shallow compression downwards and a lateral shifting of weight. Now let's stand the poles on end so that they are parallel with the skier's spine. Using the same stretch of trail, and, remembering not to twist, skate up the trail and observe any tipping motion to the left or right in the poles. If this is happening the skier is attempting to shift their weight by tipping the upper body over the ski.

However, this weight transfer should come first from the hips as they are kicked back and forth over each gliding ski. Using core strength and stability the upper body should remain on top of the hip platform, as if the shoulders and hips form a panel, thereby insuring that the body's mass is shifting from ski to ski and not just the mass of shoulders and head. These no pole drills are also great specific strength training in for the lower body. To maintain proper position core strength is also important.

Conclusion

Proper body position enables proper timing—both of which enable effective, efficient application of power.

V2 Alternate

V2 Alternate is the third gear in the skating transmission. It is used in gradual terrain where V1 and V2 would over rev the engine. All skate techniques have small variations that make them more versatile over different terrain. This is especially true for V2 and V2 alternate. The V2 alternate and a V2 alternate / V1 hybrid is being used on steeper and steeper uphill terrain.

Introduction

There are several important factors that play a key role in properly executing the V2 Alternate (V2 alt) technique. To make the discussion easier they have been broken down into body position, timing and power. Each of these components plays an integral part in executing the technique successfully. It is important that the athlete perfect each component to be successful.

Body Position

Body position in all sport is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason body position in V2 alt is similar to other ski techniques as well as other sports.

- **Feet:** Center the weight across the whole foot, with a bit more over the ball of the foot. If the weight is too far forward onto the toes it will dig the front of the ski into the snow and plow. If it is too far back it will force the hips back and make the skier carry a lot of weight on the quadriceps. The skier's weight will shift toward the forefoot as the ski is set down and will quickly shift back across the whole foot for the majority of the push phase of the skate. At the end of the push the weight will again tend toward the front of the foot but most of the power comes from skating off the whole foot.

- Ankles: The bend in the ankles is vital to positioning the skier in a powerful pushing position and into a position that prevents the ski from stalling out as it moves across the snow. The degree bend at the ankle is dependent primarily on terrain - the steeper the terrain the more acute the angle at the ankle. Also the more force the skier is attempting to deliver the deeper the angle will be.
- Knees: The angle at the ankle must be closely mimicked by the angle at the knee in order to keep the skier's weight positioned over the feet where the force can be directed through the ski to the snow. Generally skiers struggle to get the proper angle at the ankle rather than at the knee. What results is a knee angle smaller than the ankle angle, which places the skier's weight behind the feet. This loads a great deal of weight on the quadriceps and diminishes the amount of force applied to the push. The skier can think of driving the knee forward or pressing with the knee to accomplish this position.
- Here is a quick contrast of the three techniques: In the V1 technique the skier maintains a lower position throughout the skating cycle. In, V2 the skier will use a higher position in general and, especially when moving fast, rise up on a straighter/straight leg prior to the skating push. In the V2 alt technique a combination of V1 and V2 leg positions are used. (see timing).
- Hips: The hips must be over the feet. When it comes to body position this is accomplished with knee drive, maintaining the proper ankle and knee angle, and keeping the upper body in a "C" position.
- Core/Back: The upper-body, from tailbone to head, should form a soft "C" shape. Think Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural advice of your parents. This "C" position will help keep the hips over the feet, relax the lower back as well as position the muscles of the core to apply force to the poles. This "C" can be very shallow leaving the skier quite upright or rather pronounced, thereby putting the skier in an aggressive forward position. The depth of the "C" is also dependent upon terrain with most skiers adapting a more up-right shallow "C" position as the terrain becomes steeper. In V2 alternate this "C" shape tends to be less extreme than in V1.

Folding at the waist into an "r" position is the most common error skiers tend to make. This forces the hips back and generally increases the angle at the ankle.

- Shoulders: Shoulders should be rounded leaving the arms hanging free and loose in front of the body. Even skiers who ski in a very shallow,

upright “C” position should have a forward attitude at the shoulder. This position allows for a smooth pendulum swing of the arms as well as a good position from which to apply both body weight and force to the poles.

- **Arms:** In the neutral or starting position the arms should hang loose from the shoulders. The angle of the arms at pole plant should enable the skier to apply maximal force with the core and back, and the weight of the upper body to the poles. This means that the arm will be close to and generally less than 90 degrees. At pole release the hands should be low. The follow through of the arms is dependent upon speed (and terrain). The faster the skier is moving the longer the follow through can be – but doesn’t necessarily need to be. Keep the follow through short enough to help keep the hips high and to return to the poling position again as quickly as the terrain dictates (see timing). The V2 alt technique uses a poling position and motion very similar to the classical kick double pole. This is true with the return of the arms as well. In V2 alt the return of the arms is timed with the skate from the non-poling side just as it is timed with the kick in kick double pole.

Timing

In all techniques the whole body works together to transfer the weight from ski to ski and down the track. In V2 alternate, the method of propulsion on the poling-side is exactly the same as it is in V2. The upper-body and lower body compress together to transfer weight to the gliding ski. However, in V2 alternate the skier does not return to a high position on the gliding ski but stays in a relatively low position. The return to the poling-side is accomplished from this lower position with a skating push aided by the momentum of the arms swinging up, forward and back over to the poling-side ski. The synchronization of this forward arm swing and skate push is integral to the effectiveness of this technique.

V2 alternate and V1 are similar in that there is a poling side and a non-poling side. That is why it is called V2 alternate. Skiers use the V2 on the poling side but the advantage of this technique occurs on the non-poling side. While the skier is gliding on the non-poling side ski the arms are behind them. The skier rides that ski in a relatively low position. From this position the arms swing dynamically forward in synchrony with a powerful skate push back onto the poling side ski. The synchrony of the dynamic arm swing and skate push is what makes this technique so fast. On the poling side the whole body returns to the high position to initiate the double pole and skate-push that will take the skier back to the non-poling side. While the V2 alternate utilizes the double pole on only one side it is symmetrical in that the upper and lower body work together powerfully on both sides.

As in V2 the push from the upper-body must be dynamic and powerful and the depth of compression variable depending on terrain. The skate push with the legs must also be dynamic and from a high to low position. On the non-poling side the arm swing is always a dynamic and non-stop motion.

The biggest mistake in the V2 alternate technique is a matter of timing. On the poling side skiers will often attempt to pole down the skating leg (like a one-legged double pole), complete or nearly complete the poling motion and then begin the skating motion and weight shift to the other leg. To correct this the skier must remember that the whole body works together at all times to transfer weight from ski to ski and down the track. On the non-poling side skiers tend to make the same mistake they make in V1. They use the non-poling leg for a rest break. This not only kills momentum in the glide but also does not enable the arms or leg to work together in shifting weight back to the poling side. The arms will not swing dynamically from the follow-through position, and the skier will simply fall back over to the poling side rather than skate back over to the poling side. This “variation” of the V2 alternate is very common and steals all power and speed from the technique.

Power

Power results from force applied quickly. Power relies on being in a position that allows both the application of a skier's strength and the application of that strength over a short period of time. The above description of body position aims to put the skier in that position. Timing allows power development while maintaining the forward momentum of the skier.

The effective, efficient and repetitive application of power to the skis and poles is the goal of learning proper technique – including body position and timing. Once the skier can grasp the idea of proper body position it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position and develop power from it. The practice of proper timing will help develop the speed of force application.

Power is developed on the poles through the application of body weight, as well as the dynamic use of core and back. To a lesser degree, the arms also add power themselves. A lot of power comes from the upper body in the V2 alternate technique. Some skiers rely more on the upper body than others. A common mistake is to let the use of the legs suffer by focusing too much on using the upper body. Ideally, as is the case with all techniques, the whole body works together where the contributions of the upper body complements and aids the work of the lower body, and vice versa.

In the V2 alt the upper body also contributes power to the technique in the arm swing. When the forward swing of the arms is timed with the skate push on the

non-poling side and is dynamic and quick, the skate will be more dynamic, quick and powerful.

Power to the ski on the poling side is achieved through a drop of weight down on to the ski from a high position into a push position similar to that used by speed skaters. Whereas in the classical diagonal stride the ski must stop for the kick, in skating the skis must never stop. Therefore the skier will not spend time on a straight leg, but will glide with proper angles at the ankle and knee and then use the rise onto a straight leg as a quick countermovement to the skate push.

A large part of power development comes from weight transfer. This could easily be put in the "body position" section. Optimally the entirety of the skier's weight must be over the gliding / pushing ski for the skier to both glide with relaxed balance and apply maximal power to the skate. In skating weight transfer is achieved through the shifting of the hips from side to side. Many focus exclusively on shifting the weight with the upper body. This can result in a tipping or twisting of the upper body but no real weight transfer. The body's mass is best moved by shifting the hips from side to side.

In all skate techniques complete weight shift (where the skier is actually directly on top of the ski at the beginning of the push phase) can compete with the need to shift weight more quickly to avoid bogging down on steeper terrain. This can even be true in the V2 alt. While it is a technique where complete weight transfer is mandatory at high speed it is still used in uphill and even steep terrain by strong skiers. Just like in the V1 a good way to accomplish both good weight transfer and maintain momentum is to keep the feet in a wide position (never letting the feet come close together). When this is the case the skier's body will stay inside the feet and they will never be directly on top of the ski. Weight shift will still be effective however so long as the hips are shifting from side to side and pushing against one ski and then the other.

On faster terrain the skier should seek complete weight transfer. At the start position of the technique the skier will be completely over the poling side ski. While many skiers begin transferring their weight prior to initiating the skate/poling motion, the way to maximize power is to begin the initiation of the poling motion and skate with the weight directly over one ski. This will feel like the weight is dropping directly down on the ski and poles. This drop initiates the immediate transfer of weight to the other ski.

On the non-poling side the knee must continue to drive forward until the skier has completed the skating push. A variation on this technique allows a slight countermovement rise on the non-poling ski and then a quick drop down into the skate push position. This variation is used at cruising speeds and is very rhythmical and relaxing.

Drills

- **Speed Skater:** The goal of the speed skater drill is to generate full weight transfer from one ski to the next through the use of aggressive arm swing for the technique of V2 Alternate. To perform this drill properly the skier should swing their arms quickly from side-to-side without using poles – just as speed skaters do on the straightaway. The momentum generated from this arm swing directs and pulls the skier's body weight completely over each ski. See that the weight is being shifted completely not as a result of the head and upper body tipping over from side to side, but from the head and the upper body centered directly over their gliding foot. It is all in the hips. A coaching point to look for as this drill is performed is placement of weight over the foot. Weight should be over the mid section of the foot so the hips can remain in a forward position with weight supported by the skeletal system as much as possible. See too that the skier rides a flat ski. If tipping of the upper body occurs a coach will be able to see from a head-on angle that the ski is on edge and the body is not in a structurally strong position.
- **Train:** The goal of the Train Drill is to teach skiers how to ski together in a tight pack. In order to accomplish this goal the skier must learn to be aware of the timing and gear changes of the lead skier, the placement of equipment in the snow, and variations in terrain. To simplify this drill these skiers are demonstrating only the V2 Alternate technique, but it should be mentioned that a challenging twist to the exercise is to have the lead skier switch unannounced to V2 technique. Awareness and relaxation are key when skiing in a tight pack whether it is a race or an easy Wednesday night cruise.

Conclusion

Proper body position enables proper timing—both of which enable effective, efficient application of power.

V2

V2 is the second gear in the skating transmission. It is used in flat to uphill terrain where V1 would over rev the engine and V2 alternate would bog the engine down. All skate techniques have small variations that make them more versatile over different terrain. This is especially true for V2 and V2 alternate.

Introduction

There are several important factors that play a key role in properly executing the V2 technique. To make the discussion easier they have been broken down into body position, timing and power. Each of these components plays an integral part in executing the technique successfully. It is important that the athlete perfect each component to be successful.

Body Position

Body position in all sport is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason body position in V2 is similar to other ski techniques as well as other sports.

- **Feet:** Center the weight across the whole foot, with slightly more than half of the weight over toward the ball of the foot. If the weight is too far forward onto the toes it will dig the front of the ski into the snow and plow. If it is too far back it will force the hips back and make the skier carry a lot of weight on the quadriceps. The skier's weight will shift toward the forefoot as the ski is set down and will quickly shift back across the whole foot for the majority of the push phase of the skate. At the end of the push the weight will again tend toward the front of the foot but most of the power comes from skating off the whole foot.
- **Ankles:** The bend in the ankles is vital to positioning the skier in a powerful pushing position and into a position that prevents the ski from stalling out as it moves across the snow. The degree bend at the ankle is dependent primarily on terrain - the steeper the terrain the more acute the angle at the ankle. Also, the more force the skier is attempting to deliver the deeper the angle will be.
- **Knees:** The angle at the ankle must be closely mimicked by the angle at the knee in order to keep the skier's weight positioned over the feet where the force can be directed through the ski to the snow. Generally skiers struggle to get the proper angle at the ankle rather than at the knee. What results is a knee angle smaller than the ankle angle, which places the skier's weight behind the feet. This loads a great deal of weight on the quadriceps, and diminishes the amount of force applied to the push. The skier can think of driving the knee forward or pressing with the knee to accomplish this position.

Here is a contrast between two skating techniques: In V1 the skier maintains a lower position throughout the skating cycle but in V2 the skier will use a higher position in general and, especially when moving fast, rise up on a straighter or straight leg prior to the skating push.

- **Hips:** The hips must be over the feet. When it comes to body position this is accomplished with knee drive, maintaining the proper ankle and knee angle, and keeping the upper body in a "C" position.
- **Core/Back:** The upper-body, from tailbone to head, should form a soft "C" shape. Think Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural advice of your parents. This "C"

position will help keep the hips over the feet, relax the lower back as well as position the muscles of the core to apply force to the poles. This “C” can be very shallow leaving the skier quite upright or rather pronounced putting the skier in an aggressive forward position. The depth of the “C” is also dependent upon terrain with most skiers adapting a more up-right shallow “C” position as the terrain becomes steeper. In V2 this “C” shape tends to be less extreme than in V1. Folding at the waist into an “r” position is the most common error skiers tend to make. This forces the hips back and generally increases the angle at the ankle.

- **Shoulders:** Shoulders should be rounded leaving the arms hanging free and loose in front of the body. Even skiers who ski in a very shallow, upright “C” position should have a forward attitude at the shoulder. This position allows for a smooth pendulum swing of the arms as well as a good position from which to apply both body weight and force to the poles.
- **Arms:** In the neutral or starting position the arms should hang loose from the shoulders. The angle of the arms at pole plant should enable the skier to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the arm will be close to and generally less than 90 degrees. At pole release the hands should be low. The follow through of the arms is dependent upon speed and terrain. The faster the skier is moving the longer the follow through can be – but doesn’t necessarily need to be. Keep the follow through short enough to help keep the hips high and to return to the poling position again as quickly as the terrain dictates. The V2 technique uses a poling position and motion very similar to double pole.

Timing

In all techniques the whole body works together to transfer weight from ski to ski and down the track. In V2 the upper-body pushes in a double pole motion as the skier pushes simultaneously with the skating leg onto the gliding ski. The double pole and the skating push is complete as the gliding ski hits the snow and the skier’s weight is transferred to that ski. While the skier is gliding the arms and whole body return to the high position to initiate the double pole and skate-push that will take the skier back onto the initial ski. In this way the V2 technique is entirely symmetrical, with the upper and lower body working together and in the same way on both sides. The push from the upper-body must be dynamic and powerful and the depth of compression variable depending on terrain. The skate push with the legs must also be dynamic and from a high to low position.

The biggest mistake in the V2 technique is a matter of timing. Often skiers will attempt to pole down the skating leg (like a one-legged doublepole), complete or nearly complete the poling motion and then begin the skating motion with the leg

and weight shift to the other leg. To correct this the skier must remember that the whole body works together at all times to transfer weight from ski to ski and down the track.

Power

Power results from force applied quickly. Power relies on being in a position that allows both the application of a skier's strength and the application of that strength over a short period of time. The above description of body position aims to put the skier in that position. Timing allows power development while maintaining the forward momentum of the skier.

The effective, efficient and repetitive application of power to the skis and poles is the goal of learning proper technique – including body position and timing. Once the skier can grasp the idea of proper body position it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position and develop power from it. The practice of proper timing will help develop the speed of force application.

Power is developed on the poles through the application of body weight to the poles, and the dynamic use of core and back. To a lesser degree, the arms themselves also add power. A lot of power comes from the upper body in the V2 technique. Some skiers rely more on the upper body than others. A common mistake is to let the use of the legs suffer by focusing too much on using the upper body. Ideally, as is the case with all techniques, the whole body not only works together but the work of one complements and aids the work of the other.

Power to the skis is achieved through a drop of weight down on to the ski from a high position into a push position similar to that used by speed skaters. Whereas in the classical diagonal stride the ski must stop for the kick, in skating the skis must never stop. Therefore the skier will not spend time on a straight leg, but will glide with proper angles at the ankle and knee and then use the rise onto a straight leg as a quick initiation for the skate push. Being dynamic with the return of the arms to a high position helps enable this quick initiation. Just as in double pole this arm return will lend forward momentum to the skier.

A large part of power development comes from weight transfer. This could easily be put in the "body position" section. Optimally the entirety of the skier's weight must be over the gliding / pushing ski for the skier to both glide with relaxed balance and apply maximal power to the skate. In skating weight transfer is achieved through the shifting of the hips from side to side. Many focus exclusively on shifting the weight with the upper body. This can result in a tipping or twisting of the upper body but no real weight transfer. The body's mass is best moved by shifting the hips.

In all skate techniques complete weight shift (where the skier is actually directly on top of the ski at the beginning of the push phase) can compete with the need to shift weight more quickly to avoid bogging down on steeper terrain. This is can even be true in the V2 technique because while it is a technique where complete weight transfer is mandatory, at high speed it is still used in uphill and even steep terrain by strong skiers. Just like in the V1 a good way to accomplish both good weight transfer and maintain momentum is to keep the feet in a wide position (never letting the feet come close together). When this is the case the skier's body will stay inside the feet and so the skier will never be directly on top of the ski. Weight shift will still be effective however so long as the hips are shifting from side to side and pushing against one ski and then the other.

On faster terrain the skier should seek complete weight transfer. At the start position of the technique the skier will be completely over a single ski. While many skiers begin transferring their weight prior to initiating the skate/poling motion, the way to maximize power is to begin the initiation of the poling motion and skate with the weight directly over one ski. This will feel like the weight is dropping directly down on the ski and poles. This drop initiates the immediate transfer of weight to the other ski.

Drills

- **Locked 'n Loaded:** The goals of the Locked 'n Loaded Drill are many. It will teach the athlete about proper initiation of power, the role of the core, the importance of the body weight falling forward from the ankles, and synchronizing the timing of the upper-body compression and the kick in the V2 technique. These goals are accomplished by beginning the cycle with high hips and hands, just like in Double Poling. From this position, the skier crashes onto the poles with a strong abdominal crunch to initiate the power. At the same time the skier initiates the kick by dropping their weight down onto the kicking leg. Once the skier can time this drop onto the poles and the ski they may use that drop onto the ski to initiate the transfer of weight to the other ski. To isolate the powerful impact of the poles have the skier envision that their upper body is fixed in cement so that their arms do not move relative to their core. The only flex point is in the core and the lower body. By eliminating the full release of the poles as typically utilized in the V2 technique, the skier now must rely on only the force of the impact and the strength of the core to generate forward propulsion from the upper body. This short and powerful compression will catalyze a quick and snappy kick. Because the upper body is locked the retrieval of the poles and the lifting of the core to the high position is simultaneous. This generates forward momentum and causes the body weight to shift from the mid-foot toward the ball of the foot thereby initiating forward lean from the ankles. With the assistance of the body's weight now involved in the compression, the crashing onto the poles is all

the more effective. To demonstrate how this drill applies to full-scale V2 start with the locked 'n loaded drill and gradually progress to a full V2. Be sure the skiers maintain a snappy kick and an powerfull upperbody compression.

- **Agility and Stability:** The goal of the agility and stability exercises is to challenge the skier's comfort level as it pertains to balance and coordination. To accomplish this goal begin each exercise on easy and slower terrain to allow the athlete to develop better confidence in their balance and a feel for their skis. For gliding drills the skier should focus on riding a flat ski. To do this center the upper body over the glide ski hip, which is centered over the knee, which is centered over the ski. Core stability and strength are a chief component in mastering this skill. The next evolution of this drill is to add two poling motions on each side of the V2 technique. This will force a longer glide and will help the skier develop comfort and patience in staying with the glide ski until it is time to simultaneously compress and kick to the other side. All too often the skier will fall away from the gliding ski before they have initiated the kick or achieved a good start position with the poles. This will partially unload the leg before the kick happens—much like unloading your gun and then shooting to shoot the deer. In addition the poling motion or compression will be off balance. Timing is everything and balance is a crucial ingredient. The skiers must be made comfortable in these drills with the idea of failing. It is OK to fall down, and is in fact mandatory that they occasionally lose their balance as that is the sign that they are pushing their own limits. What is not OK is staying within their comfort zone and failing to challenge themselves. Even the very best skiers must push their basic limits in order to improve.
- **Sprint Skate:** The goal of the Sprint Skate Drill is to push the envelope of a traditional V2 by adding several dynamic components. The first addition that is noticeable is a hop at the end of the glide phase and a redirecting of the glide ski from straight ahead to a V angle outward like in traditional V2. This hop will draw power and synchronization to the compression and kicking phase. It should also be mentioned that this hop is the result of the dynamic return of the poles and upper body in conjunction with the small hop from the leg that brings the skiers weight up over the kicking ski. From this high position there is a lot of power coming down on the ski and poles – you gotta get up to get down! In addition, notice that in setting the ski pointing straight ahead down the track the skier can apply power to the outside edge of the ski by utilizing aggressive body lean away from that edge. The skier then utilizes a small hop to redirect both the ski and the body lean so that power can be applied to the ski's inside edge. This happens all within a single glide phase. It should be mentioned that there

are a couple skiers on the World Cup utilizing this actual version of V2 in sprint races but whether you choose to do so or not the mastering of it will undoubtedly improve your V2 and overall coordination.

Conclusion

Proper body position enables proper timing—both of which enable effective, efficient application of power.