

Classic Technique: Diagonal Stride

This is the original technique for Nordic skiing. Improvements in equipment, waxes, trail grooming have allowed for an evolution of optimal classic technique over time.

Here's video analysis of a very good junior jackrabbit 4 skier:

- Voice analysis [L2T Tech Videos - Diagonal Stride Side.mp4 \(coachseye.com\)](#)
- View from front: [L2T Tech Videos - Diagonal Stride Front.mp4 \(coachseye.com\)](#)
- Steep hill diagonal [L2T Tech Videos - Diagonal Stride Steep Side.mp4 \(coachseye.com\)](#)

Here's video analysis of a racing skier in the Train to Train phase (age 12-16):

- [T2T Tech Videos - diagonal side.mp4 \(coachseye.com\)](#)
- From the front: [T2T Tech Videos - diagonal front.mp4 \(coachseye.com\)](#)
- Steep hill diagonal stride: [T2T Tech Videos - diagonal steep side.mp4 \(coachseye.com\)](#)

Here's video analysis of a competitive racer:

- [L2C Tech Videos - Diagonal Stride - Side.mp4 \(coachseye.com\)](#)
- From the front: [L2C Tech Videos - Diagonal Stride - Front.mp4 \(coachseye.com\)](#)

Helpful Drills and Skills

Diagonal Stride Technique	
Body Position and Bounding: 1) Static position. Getting Hips Forward and Weight on the ball of their Foot 2) Dynamic Jumping (no skis). Bound from one leg to the other, landing on the ball of their feet, and jumping back to the first leg. 3) Dynamic on Skis: same as above. Hop from ski to ski. Try to get the knee to drive towards the foot and the heel off the binding 4) Bounding on Skis – slight uphill, no poles. Bounce from one ski to the other, no glide.	Skill Videos - Developing Classic Kick Drills Part 1.mp4 (coachseye.com)
Dynamic Bounding up hill: 5) No poles. Dynamically bound up a moderate hill like Trail #1B-C or 6c 6) With poles. Bound into a stride. Focus on the same kick from bounding, but add a glide even though it's uphill.	Skill Videos - Developing Classic Kick Drills Part 2.mp4 (coachseye.com)
Bounding up steep hill: 7) Aggressively land on the kick pocket, transferring all weight without backsliding. Try this on the hills between 12i and 12a	Skill Videos - Classic Grip Steep Bounding with Poles.mp4 (coachseye.com)
Kick Kick Glide: No poles. On flat terrain, skier begins diagonal stride and kicks with one leg, then the other, then glides on the first leg; then repeat for 50-75m or so. Trail 101 or 104 is ideal for this.	Skill Videos - Classic Glide Kick Kick Glide.mp4 (coachseye.com)
Balance Outrigger Drill	rollerski drills - 5. Outrigger Drill.mp4 (coachseye.com)
Diagonal Striding on Skate Skis Forces commitment fully onto each ski; load and offload fast as you can...	Nov 2017 DH and other drills - Striding on Skate Skis.mp4 (coachseye.com)

Appropriate Skills for FUN-damentals Stage of Development (ages 5-9)

Most Important Characteristics

- ✓ The skier commits weight fully to the gliding/supporting ski in the glide phases.
- ✓ The recovery foot is unweighted until placed on the snow ahead of the other foot (with ankle pushed ahead of knee as upward slope increases).
- ✓ The middle of hips is over toes at initiation of leg push, and further ahead as slope of hill increases.
- ✓ Forward body lean comes from a flexed ankle.
- ✓ Hips rotate slightly during leg push, without twisting the upper body.
- ✓ There is a pre-load and explosive leg push (knee and ankle are momentarily straightened and flexed to load the leg, followed by the forceful extension of the leg push).

Very Important

- ✓ There is complete extension of the leg and arm at the end of their respective pushes.
- ✓ There is a straight line through the upper body and leg as the push leg leaves the snow.
- ✓ The gliding/supporting leg straightens (without the knee locking) during the glide phases.
- ✓ The recovery leg is swung forcefully forward in a pendulum motion.
- ✓ The arm action is generally straight forward and back, hinging as a pendulum from the shoulder.
- ✓ Arm push ends shortly after hands pass legs, with natural follow-through continuing.
- ✓ The shoulder reaches forward on pole plant, hands at or below shoulder height.

Important

- ✓ The pole is generally planted opposite the glide foot; as the slope increases, the pole plants a bit farther back.
- ✓ The flex in the elbow joint increases as the poling action commences.
- ✓ At pole release, the skier extends the wrist/hand, with pressure exclusively on the pole strap.

Skills Progression

Bunny rabbit

Walk in place on the snow, alternately lifting skis off the ground

- Move forward in small steps keeping skis parallel
- Try this skill both in and out of the tracks

This “walking step” is the first progression of the Diagonal Stride. Success is lifting skis alternately off the snow, keeping skis parallel both in tracks and out of them.



Jackrabbit #1

In the Diagonal Stride progression, this is the “running step”. This is practised on flat terrain with set tracks. *Start without poles*

- The skier slides his/her skis down the track
- The skier “walks” down the track on the balls of the feet with some ankle and knee bend
- There is some glide onto the forward ski as the skier pushes off
- There is a “jogging-like” action on the balls of the feet, with glide onto the forward ski

• After the skier’s weight is shifted to the gliding ski, the pushing ski momentarily comes off the snow at the end of the push
 • Arms swing comfortably (in opposite time to the leg’s stride)
Coaching cues need to emphasize pushing off back foot and moving weight onto the new glide leg – it’s not a fast shuffle!



Jackrabbit #2

In the progression of the Diagonal Stride this is called the “gliding step”. It is practised on flat terrain with set tracks.

- Some glide occurs with each stride
- The skier lifts skis off the snow when kicking. There is a weight transfer about 50% of the time, and the recovery foot lands beside or in front of the glide foot.
- The skier can perform five successful strides in a row, but balance may be insecure and unnecessary movements may occur
- Poles are typically not yet used for propulsion, but are used in an alternating arm action. *(Think marching soldiers swinging their arms)*
- The body is mainly upright in the Ready Position



Diagonal Stride

In the progression of the diagonal stride, this is called the “long step”. This technique should be practised on flat terrain with set tracks.

- The skier shows a clear weight transfer from ski to ski resulting in a longer gliding action
- The ski lifts off the snow when the skier kicks
- The recovery foot usually lands beside or in front of (not behind) the gliding foot when viewed from the side
- The hands are close to shoulder height and elbows are slightly bent at pole plant
- The skier demonstrates some ankle and knee bend, and maintains a slightly forward body lean
- The poles are angled backwards and help provide propulsion; the skier is clearly pushing off of them
- Each pole is planted beside the opposite side ski boot



More Advanced Diagonal Stride Technique

“Learn-to-Train” stage of development



A full discussion of the biomechanics of diagonal stride can be found in section 8.2.1 of the CCI-L2T Reference Manual (On Snow) starting at page 252. [Click here for a copy](#). The “101” version is:

- There is a clear and equal push off with each leg, combined with a distinct weight transfer from ski to ski.
- There is a consistent and confident glide on each ski.
- The forward movement of the arm and backwards movement of the same side leg are synchronized.
- When viewed from the side, the recovery foot lands beside or in front of (not behind) the gliding foot 100% of the time.
- When the legs pass together there is good ankle and knee bend so the hips are aligned over the balls of the feet.
- The rear leg is extended at the end of the leg push.
- There is a forward upper body lean, which aligns with the extended leg at the end of the leg push.
- Hips rise at the end of the glide phase.
- At pole plant the elbows are flexed to permit a strong arm pull to be generated. They should bend further as the slope increases.
- Each pole tip is planted beside the toe of the opposite side ski boot.
- The poling action is powerful. The hands extend just past the hips.
- The pole grip is released briefly in the latter stage of each poling action; the pole thrust is completed through pressure on the pole strap.

Common Errors and Solutions

Error	Solution
<p>Poor weight shift. The skier is unable to fully commit the weight to the gliding</p>	<ul style="list-style-type: none"> ✓ Return to the basic drill of shifting from one ski to the other while standing still. Then introduce forward movement, first without poles and then with poles. ✓ The key to an effective weight transfer is in the positioning of the hips. As the weight is shifted to the right leg, the right hip wraps forward of the left hip, so that the weight is aligned through the hip and down the leg directly over the right foot. ✓ Next execute the basic shifting movement on a gradual uphill; then the same action on a gradual downhill.
<p>Poor balance. Often Diagonal Stride problems are the result of poor balance. Balance is of two types: side-to-side; and forward-backward.</p>	<ul style="list-style-type: none"> ✓ Diagonal Stride without poles can be a very useful method of improving balance and the athlete's overall technique. Athletes should be encouraged to do some of this type of skiing in gradually rising terrain to improve their balance and leg push. ✓ Striding down hill while maintaining long glides is a very good way to increase stride length and confidence while gliding on one ski. ✓ Skiing at night, with low visibility, can be helpful as it requires a skier to focus more fully because they can't anticipate terrain or track variations.
<p>Uncoordinated stride. If the skier's balance is quite good, the problem is likely a failure to replicate the correct timing and rhythm of the technique.</p>	<ul style="list-style-type: none"> ✓ Return to the basic general athletic stance without poles. Have the skier walk naturally on skis and then gradually accelerate and decelerate in turn. Stress the maintenance of a relaxed body. Then re-introduce poles. ✓ Depending on progress with the above exercises, you can have the athlete: <ul style="list-style-type: none"> • ski using the arms only in a Diagonal Stride on a slight downhill; and • ski quickly and powerfully uphill.
<p>Short strides (bobbing). The leg push propels the skier more upwards, rather than forward over the glide ski and down the track.</p>	<ul style="list-style-type: none"> ✓ Verify that the skier's ankles are bent enough as the legs pass together. Straight legs will push the skier up, not forward. ✓ Practice the scooter exercises and work on getting up and over the glide ski. It can also be useful to encourage more of a forward upper body lean if the skier is quite upright. ✓ Encourage the athlete to swing the arms more "forward" rather than up, which should draw the athlete more on to the toes and bring the hips forward causing the body to drive forward rather than up.
<p>Sitting Back. The key to an effective Diagonal Stride is to quickly push the body weight forward on to the glide ski so the skier is only on one weighted ski at a time. Skiers that are sitting back do not get good weight transfer. Often this can be seen from the side when the recovering ski contacts the snow behind the glide foot and a slapping noise is heard. The underlying problem is poor weight transfer.</p>	<ul style="list-style-type: none"> ✓ Start the skier in the general athletic stance. Tilt the body forward until the skier needs to step forward to stay upright. A good drill to complement this is to have the skier lean forward with hands supported by a coach standing in front of him/her. While retaining the leaning supported position, have the skier extend one leg behind in a follow-through position. The coach can then remove the supporting hands and the skier will automatically bring the extended leg forward to a stable position forward of the opposite foot. This accurately replicates the correct body positioning for the push-off phase of the Diagonal Stride. ✓ Emphasizing a good bend at the ankles and knees and the weight on the ball of the feet as the legs pass together will help the skier feel his/her weight forward. The skier should also feel the weight across the whole foot (not on the heels) during the gliding phase. The scooter exercises can help with this. ✓ The hip on the gliding side must wrap forward and the hip and knee should line up over the front of the foot in the glide phase.

	<ul style="list-style-type: none"> ✓ The skier's hips should not rise and fall dramatically; however, there is some up and down action as preloading occurs. ✓ Instruct skiers to look at a point three metres down the track. ✓ Exaggerate the movements by skiing "big". Bigger kicks and increased drive of the returning leg will force the athlete on to the front of their stride.
<p>Back-slipping going up a hill (not attributable to poor wax). Often skiers will start losing some of their grip while going up a hill. There are two major causes for this: 1) the skier might be sitting back (see solution above); and/ or 2) the skier "leans into the hill" with too much flexion in the trunk.</p>	<ul style="list-style-type: none"> ✓ A good coaching cue for helping a skier that is leaning too far forward is to ask the skier to look up to the top of the hill and straighten up the upper body a bit every time a back-slip occurs. In this way the skier can determine how much lean is appropriate for different grades of hills.
<p>Incomplete push-off. Many skiers do not quickly extend their hip, knee and ankle joints prior to the ski leaving the snow.</p>	<ul style="list-style-type: none"> ✓ Verify that the weight shift is complete and properly timed. ✓ Verify that the skier's ankles and knees are bent enough and the skier's weight is on the ball of the feet as the legs pass one another. ✓ Have the skier practise full extension on dryland. Have the athlete practise hopping as far as possible on one foot to get full extension. Practise next at full speed and then on snow.
<p>Poor pole plant positioning. The skier plants the pole across the front of the body. For example, on pole plant the right pole grip is near the skier's left shoulder and the tip is under the right shoulder. Such pole plant often occurs when skiers compensate for poor forward movement of the shoulder at the beginning of the pole plant. It can twist the body noticeably from side to side.</p>	<ul style="list-style-type: none"> ✓ Check the athlete's pole length to ensure a proper length pole is being used. ✓ Practise the correct pendulum-like arm movement without poles. Progress to executing the movement with poles held halfway down the shaft and kept parallel to the ground. Any tendency of the arms to cross-over will be very evident. ✓ Progress from stationary to slow-motion to full-speed poling. 