

## ICSC Lower Extremity Module 5

### Section 1.5.1\_ICSC05

#### Tier 2 to 4 Rehab of Hip

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Video Lesson: 37:14

**Tier 2 exercises primarily include two components; Aerobic Conditioning or Cardiovascular Conditioning and Static Stabilization.**

In Aerobic Conditioning, there is plenty of evidence to show that as an injured athlete is healing, we can improve cardiac output and improve systemic blood flow. Their healing time decreases and they tend to have a more successful rehabilitation outcome as well. If we are discussing hip rehabilitation and Aerobic Conditioning for the hip, we may want to consider aerobic conditioning exercises that don't necessarily include a lot of hip motion, especially if they are simply just coming out post-surgery or there is general pain within the hip active and passive ranges of motion. We may want to consider exercises such as using the Concept 2 rower and only performing upper extremity exercises to improve cardiac output. Another great intervention would be performing a seated cycling exercise such as a Schwinn Airdyne where there are generally pegs that are right around this area where the mouse is. She can put her feet up in this area and then simply use the upper body portion of that intervention. Again, Cardiovascular Conditioning is a great consideration for Tier 2 rehabilitation and it is very important for rehabilitation outcomes.

The second component that we are going to now discuss over the next main slides is Static Stabilization. What I mean by Static Stabilization is that the hip joint is co-contracting, in other words, the stabilizer muscles around the hip joint are all co-contracting or co-activating. Multiple lecturers use different languages, but the hip joint is not necessarily moving. I am a fan of closed kinetic chain exercises, especially for the lower extremity. We have a couple of exercises. As we see in the picture on the left-hand side, the supine bridge exercise. It is very common. The lumbar spine, pelvis, hip, and even knee stabilization exercise. You can see how she has a stable base with her hands flat on the table. She has elevated her hips. The close chain side, as we can see in the mirror here, is her left side. She is required to co-contrast the muscles in and around her hip, as well as co-contrast the core to maintain this position. If this patient was able to perform this exercise well, another exercise that we could make a little bit more challenging is to decrease the stability of the base. The base stability as you could see, she still has her hands flat on the ground, roughly about 30 to 45 degrees of abduction. She is still pretty stable here, but we have now added a ball underneath her legs, which increases the instability. It is making it more challenging to co-contrast her hips and core.

My goal for my athletes when they are performing these very basic Tier 2 types of exercises is to be able to maintain a static hold or static co-contraction for 90 seconds to 120 seconds. If they can do that, they have already reached moderate fatigue, then we can make things more challenging for them. If she were to march in place, for example, performing this supine bridge in several repetitions or marches, it does not appeal to me. I am more concerned about the time when we are talking about the stabilizers of a joint. We are more concerned about developing motor endurance. We are interested in reaching 90 seconds to 120 seconds. Here is a video example of how we will perform a supine bridge. This patient or athlete has his hands roughly out at 30 to 45 degrees creating a stable base. He brings his feet in, and he elevates his hips by extending his hip. You can see that we have the close chain side on the right-hand side. Now, he is going to switch and now we have the closed chain side here on his left-hand side. This is an exercise where he is marching back and forth. We will play it just one more time. He is marching back and forth and I am more concerned about the closed chain side. You can certainly just sustain and maintain a closed contraction exercise or pull just on one side and not march back and forth.

My objective is 90 seconds to 120 seconds, where he can march back and forth if we are rehabbing the hips. If we are rehabbing just one hip, 90 to 120 seconds upholding just that one hip. Now, to make things a little bit

more challenging as you will probably see through the next two slides, it is to bring his hands closer to his midline or even bring his hands up over his head. That will decrease the stability of the base. Another great closed chain exercise is this 4-point position. We call this a 4-point position that we are going to see more so when we get down to the lower right video. He is in a 4-point position, with two knees and two hands, he is in this 4-point position and what he is going to do is raise one hip. It might be easy to believe that the hip we are exercising is the hip that is elevating, but that is not what our objective is. The hip that we are exercising is the closed chain hip. Because the closed chain hip, which is going to be his left side or the one in the mirror, is co-contracting as well as orchestrating its ability to co-contrast with the core. That is important for the normal function of stability, it is to have lumbar pelvic stability that is also well-coordinated with the stability of the hip. Here, we have an athlete who has knee inflexion. Not a lot of our athletes have an inflexion, but we are going to show you more closed chain hip extended exercises.

Again, he is in a 4-point position, going to a 3-point position. The closed chain side is the side that we are more concerned about. The outcome goal is 90 seconds to 120 seconds. What if he fatigues at 30 seconds? We will help that out with something that he is going to continue, including his exercise routine or rehabilitation program. He will continue that exercise until he develops enough neuro-motor endurance and until he reaches 90 seconds to 120 seconds. Here is another exercise that is a little bit more challenging. You can see that this is going to be more consistent with the Bird-Dog type of exercise where he is raising one hand and extending one hip. He is going into a 2-point position. It is pretty challenging, but again, we are more concerned about the closed chain side. If we do have an athlete who has a left hip issue, it is common in my experience, that the athlete probably has had some right shoulder issue as well. Because of the kinetic chain diagonal pattern that we often see in movement throughout the sport. If we have an athlete that does have that complex issue with contralateral hip and shoulder issues, this is a great exercise for establishing co-contraction stability.

Earlier, we mentioned developing static stabilization of the hip while in extension. Here are a couple of videos that we are going to show you now. I am a fan of slosh bars. I am a fan because this is simply a PVC pipe or pipe that you can get from your plumber. What I placed in here is roughly anywhere from six pounds to about 16 to 18 pounds of water. For my international students, you're going to have to convert that to kilograms. But anywhere from six pounds to about 16 pounds works well. I would not go heavier than that or the weight of the slosh bar just becomes too harder to handle. You might be more prone to injuries. Quite honestly, 16 pounds is hard. High-level athletes are incredibly challenged with simply 10 to 12 pounds of water. The ends of the slosh bars are sealed, and this is roughly five feet long, just to give you an orientation of what the slosh bar is made of. Here, we have a slosh bar, and it is close to his core so it should be a little bit easier. It is important to understand progression. You can see that he started with his feet wide, and now, he brought his feet in narrow. If he is challenged to just stand there with his feet narrow and holding a slosh bar while these waters are trying to develop a balance, we are just going to hold him there. We don't want to advance him. We don't want him to fall, especially if that proprioception is efficient.

If he can stand with a pretty good balance with his feet together, we can ask him to raise one leg and balance on one leg. Again, we are more concerned about this closed chain side developing a well-orchestrated and coordinated manner of balance and stability between his core and left hip. We are just going to fast-forward here, and we can see that he is trying to balance this water while he is co-contracting on that hip. Now, if this patient can reach that simple goal of 90 seconds to 120 seconds with hardly reaching moderate fatigue, we can make it more challenging. As I said, progression is very important. How do we progress this to another level that is not too challenging, but just a little bit challenging for him? Well, let us add some movement. Let us add some movement on the upper body, which is going to result in that water wanting to slosh a little bit more and increasing the challenge of him being able to co-contrast his core in conjunction with co-contraction of his hip. You can also appreciate the entire lower kinetic chain. It would include the ankle and knee. As you continue with this rehabilitation module, we will get into knee rehabilitation. You are going to see a lot of the similarities like this. Now, this was an exercise brainstormed by one of my students. He was doing this across the room when I was teaching rehabilitation and I thought, "What is this crazy student doing?" As I saw him and I played around with it, I do like it. We just call this an offset slosh bar.

We now have a lot of the potential weight of about a 12-pound sash bar all to one side, which loads up the core a little bit more progressively on the opposite side. His right QL, for example, is a little bit more toned if you will when he is trying to co-contract his core. This athlete is also raising one leg resulting in a good closed kinetic chain balance. We can appreciate that our athlete is under a lot of different asymmetric loads. This is a good example of how we can implement that in a strategic manner. The outcome goal for him to stand in this position would be 90 seconds to 120 seconds. If he can do this well, we can progress. How do we progress on? As I said, progression is very important. I said that many times, so you are probably going to see that in the quiz question. It is important because this is how you proceed in a safe and effective manner for your athlete. Let's talk about some progressions. If we are going to do a wall sit exercise, for example, we might start with the patient's back against the wall and maybe her hips and knees at roughly 35 to 45 degrees. We will have her co-contract her core with co-contraction of the hips, knees, and ankles, and hold that position. The outcome goal is 90 seconds to 120 seconds. If she can knock this out of the park with very little fatigue, we will have her lower herself on the wall to 90 degrees. Where her hips and knees are at 90 degrees and hold that position. If she can do that very well for 90 seconds to 120 seconds, we can decrease the stability of the base even further.

These are all Tier 2 exercises still. How do we decrease the stability of the base? We can put her feet on an unstable surface such as the cushion of your couch or a pad that is a little bit softer. Or we could decrease the stability of the wall and have her place her back on a gym ball. She truly must increase the co-contraction ability of her core and her hips when she is on a more unstable surface. These are all Tier 2 exercises. Progressing onto Tier 3 would involve adding more range in motion of the hips [inaudible]. We are adding a range of motion on the hips and knees. We are going to continue this discussion further in the next video, but you could see this athlete has a little teaser here. He is performing an exercise that we were doing here, but now we've added some movement to the hips and knees while he is having to co-contract his core and knees. Now, you did notice that he started with his hips rather wide, right? His feet are rather wide where he was more stable. We will say that he was able to knock out 90 seconds to 120 seconds easily, so then we want to make it a little bit more challenging. We brought in his feet, decreasing the stability of his base, and making it more challenging. The last slide here is just to introduce something that we will talk about and demonstrate a little bit further in the next video and that is vibration.

Vibration plates are fairly common. There is fair evidence to show that these vibration plates do increase muscular tone by stimulating the muscular spindles or muscle spindles. It may benefit some of our patients who are very proprioceptive-deficient such as our senior population. Now, I would not put my grandma on a pad such as this without any type of protection. Most of the vibration plates you see would have some bars where they can help them out to balance. We will conclude that in the video here with Tier 3, we are discussing mostly something that is discussed and titled Dynamic Stabilization. Dynamic stabilization of the hip involves co-contraction of the hip muscles in coordination with the core, but also while the hip is dynamically moving through a range of motion. Of course, we know the hip is very mobile, it can circumduct. It can go through all of the planes; transverse planes, rotational planes, sagittal planes, et cetera. We want to make sure that the hip is stable first and coordinating well with the core in these multiple planes that we will be discussing in the next few slides. As we progress onto Tier 4, Tier 4 discusses more on building strength on that stability.

Tier 2, we talked about Static Stabilization, the hip joint remaining stable when it was also not moving. In Tier 3, we are talking about the stability of the hip and core, while the hip is also moving through a variety of ranges of motion. As you can imagine, performing just a simple squat exercise from a hip extended position to this hip flex position, it is going to require the hip to maintain some level of stability in conjunction with the core stability whilst it is moving through that range of motion.

If the patient finds that squats are very easy to do, reaching that 90 seconds to 120 seconds pretty easily, we can have the patient progress to a single-like lunge. If they can perform 90 seconds to two minutes easily with the single-like lunge, we can decrease the stability of the base as we see here. These products here are from TheraBand and Performance Health. This is a pad that is not as stable as the ground would be. If the patient was able to progress easily, 90 seconds to two minutes on this, we will progress him along these more challenging pads which creates less stability. That will be making it more challenging. We can see that the athlete here has a

little bit of a wiggle right in his core particularly, maybe a little bit of wiggle along the knee and hip as well. This is something that we will continue to monitor, assess, and make sure that he is stable before progressing. Earlier, in the Tier 2 lecture, we finished briefly discussing the vibration pads or vibration platforms. The evidence is decent regarding showing that it tends to balance out the tone if you will around a region. In this case, we are talking about the lower extremity, and even more specifically, the hip. What we are going to see in this video is this athlete on a vibration pad. He is pressing the on button and the vibration pad is going, and he is going to perform a little step up. These arms or little bars here are there to allow your patients to stabilize themselves if needed. This athlete is just challenging himself quite a bit by doing a step-down or step back while on this vibration pad.

You can see that there is a fair amount of motion on his ankle, knee, and hip. It is probably a little bit less on his core compared to the previous athlete, but right there in his lower extremity, there is a little bit more instability. My goal is for him to be able to perform this for 90 seconds to two minutes. I do not care about the number of repetitions. I just want good, slow, and controlled stability. If we found out that his knee was going into genu valgum or his hip is going into internal rotation quite dramatically, we can facilitate external rotation of the hip by taking a TheraBand and strapping it onto the bar. You can see that he is pushing out against the pad, firing extra rotators on the abductors at the hip, which might retrain the neuro-motor pattern of the hip while performing this challenging exercise. Those exercises can be done without the vibration plate, but we are just including the vibration plate. We are showing you just another concept of rehabilitation. Another concept of rehabbing the hip in this dynamic stability manner is to have the hip joint move, but not in the sagittal plane as we saw in the previous videos. What we are going to do is have the hip joint move more on the transverse plane. What we are going to be doing in a closed chain pattern, we are going to have the pelvis rotate over the top of the femur that should be moved. Here, we have the lower extremity, which is not technically necessarily moving. We have the hip joint, the acetabulum, moving over the femoral hip. This requires an incredible amount of co-contraction and stability of the core and hip. It is an exercise that should be implemented for all our athletes. We see this activity in a variety of different sports.

You can see that he is grabbed some Theratube in here now, just to encourage a little bit more unilateral resistance while he is co-contracting his core and hips. We will talk about unilateral resistance a little bit more in the upcoming slides. We can make Tier 3 Dynamic Stabilization exercises as dynamic as we want. Here, we have a slide board. This is a slippery surface and she is wearing special slippers that allow her to slide across the slide board. As she is pushing from one side to the other, she is catching herself, decelerating her body, gathering up her mass, and then pushing it again across this direction. Just that pushing motion, the sliding motion, and catching at the end and decelerating herself, are activities for her hips, core, and knees. They are doing that on a regular basis throughout sport and more so in sliding sports such as ice hockey, but similar motions in a variety of different sports. So even while she is translating that across a slippery surface, the amount of core and hip stability is quite elevated. Now, we talked about this transverse plane when we were on the vibration pad. If you have the ability to have them on slippery surfaces, and quite honestly, if you just have linoleum or a tile floor, this also works pretty well. We will just have the athlete actively internally and externally rotate their hips by just sliding their feet in internal and external rotation while in a closed chain manner. It results in a pretty good co-contraction of the hips while dynamically stabilized throughout a range of motion, internal and external rotation.

Another Tier 3 exercise, a couple of my favorites, is monster walks. Here, we have a young athlete with a TheraBand around her legs. We can also place that TheraBand a little bit higher, but while she is walking around your rehab center or even sending this home as a home exercise. While she is walking around, the hips are actively having to contract and increase their tone a bit more into hip abduction while she is in the open chain state. When her leg is in the air, of course, the TheraBand is going to want to pull that leg in so we have to increase the tone a little bit on these hip abductors. They are very functional. She is in a great position. She is on her feet. She is going through open-close and open-close while she is walking around. This would be great for an athlete who has maybe glute medius and some other hip abductors that are just not functioning the way they are supposed to. I know there is a common exercise out there called the clamshell exercise that a lot of people love to prescribe to their patients because the EMG study shows that the clamshell exercise is very good for

hitting the glute medius, but I just don't see my athletes in that clamshell position very often. Even though there is an EMG study that I am aware of yet that showed that these hip abductors are as high level as the clamshell, I know from practical and anecdotal experience and outcomes that this works very well in a much more functional manner for my athletes.

Another very functional exercise going from a standing position to a lunge position is this exercise. Again, here we have an athlete that has a little bit of a deficiency in being able to maintain his knee over his ankle when he goes into this lunge position. One thing that you can do is implement some biofeedback. You could see that he is touching that glute medius and he can also touch his external rotators or abductors of the hip. You can create some biofeedback to try to re-establish a sagittal plane movement by keeping his knee under his hip and over his ankle. It works well. I have pretty good compliance with that type of exercise with my patients. Another high compliance outcome is using TheraBands. We are just on a different medium now. If he is turning in, we can tie this TheraBand to a door or just furniture and have him fire out against the resistance and keep the knee beneath the hip and over the ankle. Firing out, in other words, requires probably some hip abduction and external rotation. Increasing the tone and doing repetitions repeatedly will hopefully retrain the neuro-motor patterns. That is the outcome. I have a very good outcome with this type of intervention from a compliance perspective, as well as my athletes responding with appropriate stability, and eventually, strength when we talk about strength. We are not so concerned about strength. With Tier 2 and Tier 3, we are mostly concerned about neuro-motor control. It is very important as we progress with some more Tier 3 exercises.

Here, we have this athlete in a supine bridge exercise. There is a very wide base, 45 degrees out, and he is pulling a gym ball into his backside. This is a great hamstring exercise as well as a hip and core stability type of exercise. To make this more challenging, what we would want to do is decrease the base even further. How do we decrease the base? We bring his arms in. We are bringing his arms into his side and making it far more challenging. Some of you will recall that and some of you will already have the answer. How do we know when we should progress from this to this? The answer is that magical 90 seconds to 120 seconds. If he can perform leg curls in this position for 90 seconds to 120 seconds hardly reaching moderate fatigue, he or she is ready to progress to a more challenging position. When this athlete can do it for 90 to 120 seconds in this position with very little difficulty, then we are ready to progress to another level. What is that next level? Advancing the arms over their head. This is pretty darn challenging. To put the feet on the ball, elevate the hips as high as we can. Ideally, on a straight line, but you can see he is a little bit low. It is a straight line from the shoulders, hips, knees, and ankles when he is out straight. I don't care about the number of repetitions; I am more concerned about the time. If he can knock out 90 seconds to two minutes, you can add another progression, and ask him to do a single leg. We might want to train the athlete to do a single leg exercise by bringing their leg in and then elevating one leg and slowly returning the ball to the extended position.

You will notice that we did return him to his more stable platform, the stable base, with his arms out at 45 degrees. That would be my suggestion. If the athlete is able to progress well, in other words, reach those 90 seconds to 120 seconds, make him bring the hands in and elevate them over the head as we did earlier. Slosh bar, as I said, I am a fan of slosh bars. We are going to talk about slosh bars in a dynamic manner, in other words, the hip joint is now going to be co-contracting but also throughout a range of motion. Here, we have a slosh bar close to the axis and spine. He is simply doing a squat and he is doing a squat with his feet wide. If he is able to knock out 90 seconds to two minutes performing this exercise, you can bring his feet closer and do some closer-based squats and try to reach that goal of 90 seconds to two minutes. Another option is to have him perform lunges. The slosh bar is close to his core again and he is simply doing some walking lunges nice and slow and controlled. If his knee is going a little bit in front of his feet, I would prefer his foot to be more outward so that the ankle dorsiflexion is much lower on his hands and knee. Or we can have our athlete perform backward lunges as you can see there. Again, my goal is not to have him perform X number of lunges, it is to be able to perform this for 90 seconds to 120 minutes before progressing. Another progression that we can consider is performing an overhead squat. Holding that 12 pounds or 10 pounds of water, sloshing back and forth in that bar, and having him or her perform an in-place squat. We can start with a wide stance squat, and if the patient is able to knock this out easily, we can narrow the base and make it more challenging.

Another squat with a push press, just adding a little bit more complexity to the squatting motion that we saw earlier. You will notice that his hands are wide on the slosh bar. We can make it more challenging by narrowing the hands on the slosh bar, which adds more load to the core and hips as well in this context. If the patient was able to do well with this, you could even narrow the base of where she is standing. The outcome goal for this is 90 seconds to 120 seconds. As we saw earlier on the vibration plate with the other athlete, he was performing a TheraBand exercise, there is another version of it. It is on the stable ground without vibration. His closed chain side is his left hip and what he is doing is he is rotating his pelvis over the closed chain. The femur is not necessarily moving, it is the pelvis that is moving over the top of the femur. What he is doing is he is contracting the internal rotators against a unilateral resistance. This is a closed chain, which means his hip and core are co-contracting. We are working on the stability, but now we are working on the stability with a little bit of resistance. Now, we are starting to just progress a little bit in Tier 4, and Tier 4 is talking more about strengthening and not necessarily discussing neuro-motor control. We are just verging on some Tier 4 exercise with this. Here's another motion of it, this working more on the external rotators. We are working on the right leg now and it is now in a closed chain pattern. His pelvis now is closed, in other words, his hip joint is in internal rotation right here. And then he is firing his external rotators to rotate the pelvis over the top of his femur. Again, co-contracting of the core and hip, but now we just add a little bit of a unilateral resistance.

It is a great way to progress. It is the later stages of Tier 3 before going into Tier 4 exercises. Another dynamic holistic exercise for Tier 3, working on neuro-motor control is a box drop. Earlier in the functional assessment video, we saw the athlete drop. When he dropped and landed, we saw his knees come together, in other words, he went into genu valgum. His lower extremities were unable to maintain a good and stable position. The stable position is for you to have that knee directly between the hips and ankle. In the case of the video earlier, the functional assessment video, his knees went into genu valgum. What do we do? We try to facilitate hip abduction. We have got a TheraBand wrapped around his knees, and he is having to actively fire against this TheraBand and firing up his hip abductors. You can see that compared to the earlier video, he is doing a bit of a better job of maintaining his knees in between his knees and ankle. There is a little bit of a wiggle there, especially on his left side, on our view, it is right. Nonetheless, done repeatedly, that should help establish some holistic neuro-motor control. Tier 4, we call it Mobilizer Conditioning, but it is a strengthening phase. Traditional strength training exercises are implemented such as performing a leg press. Some other Tier 4 exercises are using weights at the end of your limbs. As you can see, we are now talking about open chain exercises.

A lot of these strength-building exercises for the lower extremity are a mixture of either a closed chain where the feet are fixed or an open chain where the core can move. Here, she is working on some abduction on the left-hand side, she is working on the abductor. We are working on strength; this is not a neuro-motor control exercise. This is a strength exercise. It is very important to build that base of neuro-motor control before we start working on strength exercises. In the picture on the right-hand side, you can see now that she is working this down her leg, and she is working on the abductors by lifting this weight on the end of her leg. What are the outcomes? What are the goals? It depends on what sport they are playing. If they are playing a sport that requires high strength and high power, I would be looking at performing a strengthening exercise with lower repetitions. If she was participating in a sport where muscular endurance or strength over a long period of time is necessary like soccer or wrestling; a wrestling match is three minutes to five minutes, we might want to consider doing higher repetition exercises. Here is another example of an exercise for working on abductors in the picture. On the left-hand side, she is working on the abductors as she is firing that abduction against this resistance. You can see that she is balancing herself on this bar. Now, she is just turning the other way, and she is pulling into that abduction against the resistance of this TheraBand. It is another open chain exercise. Here, we have this athlete firing into hip extension as you can see in the mirror. She has this TheraBand strapped over her lower leg, and she is simply firing into it in an open chain manner with the hip extension.

She might want to use something for balancing. Now, she is just turning the other direction, and she is firing a hip flexion against a resistant TheraBand with her knees straight. With her knees straight, she is working a lot of her hip flexors. Now, she is flexing her knee and she is got the TheraBand wrapped around her heels, so it does not slip around too much. This might be more consistent with working the knee flexors or hamstrings. There are a lot of different exercises in fitness centers or gymnasiums where we have machines such as leg extensions or

leg curl machines. This would work well also for developing strength. As we take our athletes through higher levels of Tier 4 strengthening exercises, the squat applies to that type of exercise. We might want to add some variety. Occasionally, our patients might be plateauing regarding their strength, then maybe we just want to add a little bit of challenge. Here, we see this athlete doing a front squat with elastics with added weight, and the weights are moving around a little bit. It creates a little bit of movement on this front squat and makes it a bit more challenging. With this athlete, we are going to back off on the weight because we are making the bar more unstable and adding some perturbations to his exercise, so he is not going to be able to lift as heavy safely. It is very important that we consider that. This is just simply a variation of a squat exercise that we could have our patient perform. With that, I thank you for your attention to this, we have now completed the rehabilitation of the hip.

[END]