

NEVADA
PHYSICAL THERAPY
REHAB/STRENGTH/PERFORMANCE

An Updated Anterior Cruciate Ligament Rehabilitation Protocol



Anterior Cruciate Ligament Reconstruction Rehabilitation Protocol

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ACLR PROTOCOL GRID(BPTB)

Phase 1 Therapeutic Exercise	Wk 1	Wk 2	Wk 3	Wk 4	Phase 2 Therapeutic Exercise	Wk 5	Wk 6	Wk 7	Wk 8
Heel Slides/PROM Flexion	•	•			Upright Bicycle	•	•	•	•
Calf Stretch	•	•			Standing Hip Abd (Bilateral)	•	•	•	•
Passive Extension (Supine/Prone)	•	•			KB Squats (90 deg)	•	•	•	•
Quad Sets	•	•			KB Wall Sits	•	•	•	•
Resisted Calf Series	•	•			Loaded Lunges (surgical leg FWD, light weight)	•	•	•	•
Knee Ext ISO 90 deg		•	•		Step Up/Downs (4-6inch)	•	•	•	•
Standing Hip Abduction (INV leg Stance)		•	•	•	KB RDL	•	•	•	•
Partial Sit Ups		•	•	•	Prone HS Curl (light weight)	•	•	•	•
Overhead Abs		•	•	•	Eccentric 1L Leg Press (light to moderate)	•	•	•	•
SLR Flexion (standing)		•	•	•	Standing Pallof Press	•	•	•	•
SLR Ext (standing)		•	•	•	RNT Step Down Progression		•	•	•
Wobble Board/Weight Shift		•	•	•	Lateral Agilities		•	•	•
Mini Squats		•	•	•	SL RDL			•	•
Banded Hip Hinge Holds		•	•	•	SL Sit to Stand				•
Unresisted Bicycle		•	•	•	Side Planks				•
Standing Calf Raises		•	•	•	**Phase 3-5 Therapeutic Exercise**	**Month 3**	**Month 4**	**Month 5**	**Month 6**
Knee Ext 90-45 deg (no resistance)		•	•	•	1L Bridge/Frog Bridge (week 8-10 as tol)	•			
Wall Sits			•	•	Barbell Back Squats/RDLs (week 12)	•			
Eccentric SL Leg Press (light)			•	•	Single Leg Hip Thrusters (week 12)	•			
Standing Lunges (surgical leg FWD)				•	Nordic HS Curls (week 12+)		•		
Single Leg Balance				•	Jump Skill/Run Skill Block Progressions (week 12-14)		•		
Step Ups (4-6inch)				•	Knee Extensions		•		
Phase 6-8 , Final Phase	**Month 7**	**Month 8**	**Month 9**		**First RTS Test Block 1 (week 16)**		•		
RTS Block 3	•				Bilateral Lunges, week 20)			•	
RTS Block 4		•			Copenhagen Planks			•	
Unanticipated Jump Skill Block		•			Sprint Block Progressions			•	
Begin *Contact* Workload Accumulation		•			**Second RTS Block 2 (week 24)**				•
RTS Block 5			•		Begin *Non-contact* Workload Accumulation (week 25+)				•

A Complete Guide to Rehabilitating Athletes

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Introduction

Current Anterior Cruciate Ligament Reconstruction (ACLR) rehabilitation protocols often focus on three major tenets: Protection of the repair, Improving knee range of motion and strength to "within normal limits" and Safely returning to sport. Despite hundreds of articles highlighting these points, incidence of re-injury continues to be high and further, it has been demonstrated that even if there is no re-injury, only 63% of athletes return to their pre-injury level of performance (Ardern et al 2011). This suggests that current rehabilitation models and return to sport parameters may not be addressing the appropriate deficits. At Nevada PT, we are committed to using the best available research in designing and implementing our rehabilitation protocols and the current evidence suggests that the key to successful rehab lies in appreciating the multi-factorial nature of ACL injury and re-injury. Components of the multi-pronged approach we use include:

- Increased hamstring strength emphasis (in addition to established quadriceps protocols)
- Equal lower extremity performance during athletic movements such as jumping or cutting
- Improved core strength and
- More stringent return to sport benchmarks then industry standards.

Additionally, we hope to advance the discussion on when to clear an athlete to return to play; a complex decision that includes more than just clearing objective testing criteria. Finally, the establishment of an acceptable "chronic workload" as an athlete or patient is resuming athletic participation is an update on the "envelope of function" concept (with new objective risk factor ratios) and may become a cornerstone of reducing injury risk with not only ACL injuries, but rehabilitation in its entirety (Blanch and Gabbett 2015). While the following protocol borrows many tried-and-true rehabilitation theories from the best in sports medicine, it also incorporates new progressive models to address the above-mentioned goals.

70%

The percentage of rehab clinicians that use manual muscle testing to measure strength in ACLR testing- Greenberg et al 2019

Minimum weakness needed for manual muscle testing to be valid- Nagatomi et al 2016

25%

Phase 1 Progressions

Patients are strongly encouraged to be seen in clinic within 72 hours after surgery as this allows us to establish rehab expectations, decrease potential for sub-optimal movement patterns inadvertently adopted that may compromise healing, minimize excessive strain on the repair, etc. The phase 1 protocol pays special attention to patient education, weight progression recommendations, strength progressions within the lens of minimizing graft strain, and maximizing potential for resolution of inflammation. Symmetrical extension should be achieved as early as possible, with a goal of achieving equal bilateral hyperextension within the first 2 weeks. Additionally, normalizing patellar mobility, preventing or minimizing scar tissue formation and facilitating improved quadriceps activation (Wilk 2012) should be emphasized at this time. If abnormal scar tissue is allowed to form, extension deficits may persist or if the inflammatory cycle is allowed to continue after the first several weeks, the patient may have continued difficulty throughout the ACL rehabilitation program. Aggressive pursuit of phase 1 goals often sets the table for a smooth rehabilitation progression in the next several months.



Hamstring Strength

Hamstring laxity or weakness has been suggested as a primary indicator for ACL injury susceptibility, specifically in the female population (Hewett 2006). Additionally, hamstring activation unloads shear forces on the ACL, especially during athletic movements such as cutting and sidestepping (Weinhandl 2014) and it would follow that a program emphasizing ACL repair protection would have a strong hamstring component while continuing the well-established quadriceps and hip musculature strengthening of many current rehab programs. The following protocol addresses this in multiple approaches: primarily in the form of deadlift progressions (Escamilla 2002) such as assisted band-work, bodyweight and single-leg movements, kettlebells and finally barbell work as appropriate with additional attention to eccentric HS strength, i.e. Nordic Hamstring Curls. While squat progressions are well known (yet amazingly still under-utilized), very few protocols incorporate deadlifts and if they do, it is often in a single-leg platform with a balance or neuromuscular emphasis. Additionally, hamstring weakness when matched to their male counterparts, as opposed to quadriceps weakness, may be a bigger predictor for ACL injury and subsequent re-injury in females (Myer 2009). Not only is the deadlift, when performed correctly, safe for the reconstructed ligament, it is a multi-joint, hamstring dominant movement requiring strong core activation. Hamstring weakness is a well-documented risk factor for ACL injury (Myer 2009; Weinhandl 2014) and is a notoriously under-emphasized component of many rehabilitation programs.

Functional Strength

While the intent of this protocol is not to define what "functional strength" is or is not, for the purpose of this conversation we are focusing on compound movements such as the squat and deadlift as well as specific testing described by Hegedus et al (2015) in his ACL reinjury investigations. The deadlift (and barbell squat) addresses core strength to a greater extent than conventional "core" exercises (Hamlyn 2007) and combined with the previous discussion of the importance of hamstring strength, this lift is one of the foundations of this protocol. Additionally, we program specifically to improve strength and performance of various movements detailed in the aforementioned study by Hegedus et al 2015 such as side plank hip abduction, single squats, etc. While these are novel tests for ACL injury risk reduction and will require further validation in the future, we feel they offer a more complete picture of an individual's athletic performance capabilities than conventional protocols. Detailed below, the primary emphasis is to establish side-to-side symmetry in various tasks and an objective progression criterion is an important component to our rehabilitation applications.

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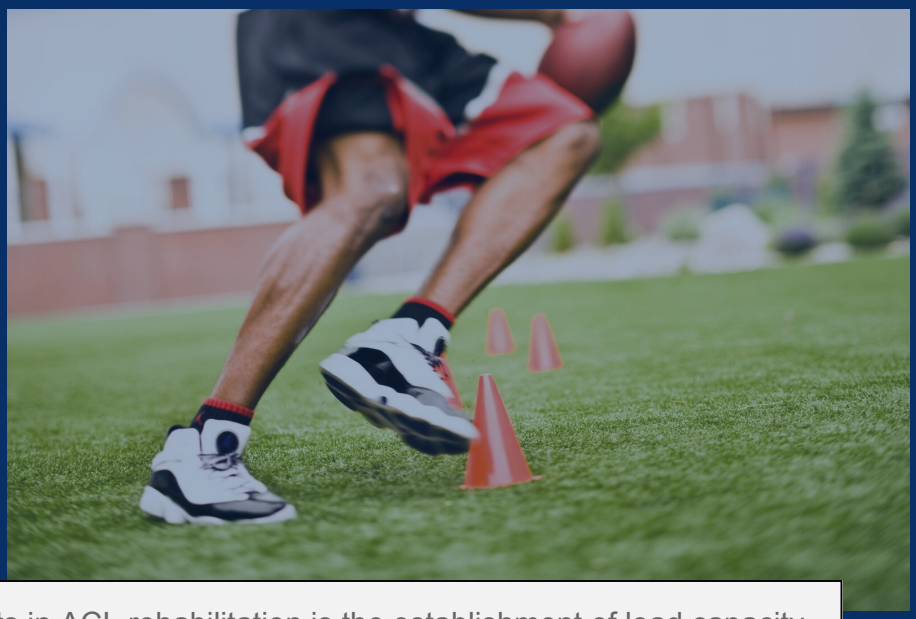
"Goals by week 16-22: 75% strength of uninjured side"

van Grinsen et al 2010

Lower Limb Symmetry

Isokinetic testing has long been the norm for measuring lower extremity strength, specifically with return to sport following ACL repair. Consistent decrease in knee extension values are shown as far as 12-24 months after surgery (Xergia 2013) suggesting current quadriceps-specific therapeutic exercise is either ineffective, underdosed, or potentially both. The concern with this type of testing, in our opinion, is that it is single-joint and as such, its predictive implications on athletic movements and the multi-joint systems they require may be overstated when used exclusively for readiness to return to play. Additionally, access to the extremely expensive Biodex units the research is performed on may limit accessibility to smaller clinics. Despite the limited application of Biodex testing for most clinics, it is important to establish an objective measurement for side to side limb symmetry as well as quadriceps/hamstring ratio as these have been suggested to be continued risk factors for re-injury for Return to Sport (RTS) athletes (Kyritsis et al 2016; Knapik et al 1991). While the single-leg hop tests may offer a more complete picture of return to sport deficits in the ACLR athlete, specifically decreased knee flexion angles in load production and increased plantar flexion angles in load absorption (Xergia 2013), again current rehab protocols may not be addressing the complete athlete. We use an objective testing protocol to measure hamstring and quadriceps strength both in isometric positioning as well as functional testing (e.g. peak power, eccentric hamstring control, single leg squats, etc.). Compound multi-joint training with an objective measure on individual leg output may address the above-mentioned deficits with return to sport and is an important component to the multi-factorial approach it takes for comprehensive ACLR management.

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Workload Capacity

One of the most overlooked components in ACL rehabilitation is the establishment of load capacity. Too often the decision for Return to Sport (RTS) is based entirely off subjective reporting of the athlete and time from surgery which we detail below. While it has been suggested that the risk of re-injury decreases by 50% for *every month* the decision to clear an athlete is delayed after the 6-month mark (Grindem et al 2016), consistent evidence is emerging that the RTS decision is far more complex than that. For this protocol, we will focus on the components we can influence or modify; the non-modifiable risk factors such as gender, sport-specific risks, exposure, etc. should be considered as well.



Image source: Rambaud et al 2017

ACWR: Acute Chronic Workload Ratio

ACWR establishment has recently been gaining traction in the re-injury risk conversation and while it applies directly to ACL rehabilitation (Blanch and Gabbett 2015), we also feel it is a foundational concept in all non-contact injuries whether they be muscle strains and re-strains, tendinopathy or even osteoarthritis. Exceeding the load capacity beyond the levels these specific structures have adapted to over time has been well documented in the degenerative cascades seen in tendinopathy (Cook et al 2015). Essentially, the Acute:Chronic ratio is an objective number comparing the athlete's chronic workload (in this article, the previous 4 weeks although we feel it can be applied to months or even years) to an uptick in volume over a much shorter period of time (e.g. current week). Blanch and Gabbett established that a ratio greater than 1.5 significantly increases an athlete's risk for re-injury (2015). This concept integrates seamlessly with our RTS programming as Return to Sport must be treated as a continuum or a curve rather than a single inflection point. In order to be cleared for return to sport, an athlete must establish an acceptable chronic workload (70% of acute in-season demands) to minimize this spike in activity and potential injury risk.

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External Cueing

Additionally, many clinicians have had the displeasure of coaching an athlete or individual for months and observing that while they demonstrate textbook jumping mechanics in the clinic, as soon as they hit the field they often revert to their default programming. Upon further investigation, we have found a wealth of research proposing a mechanism to improve this and it may reside in our brains, not our joints (Wulf 2013). While this is given many names (cerebellar training, reflexive training, CNS facilitation etc.), one thing has become clear: for an individual to truly learn a new movement, it must be coached entirely different. In this version of our protocol, we have emphasized specific cueing to establish an external focus for an individual when performing a movement rather than an internal focus. How many times have you been told to keep your knee over your 2nd and 3rd toe when performing a step-down? Or to "land with your hips and knees flexed" when jumping? An external locus of focus would be, for example, coaching the above movements by telling an athlete to "try and touch the cone when you step down" or to "push the ground away and land soft" when jumping. This may be a simplification but it is perhaps one of the biggest changes we can implement with our ACL patients to ensure a new movement pattern that may reduce their risk of injury is not only able to be demonstrated in the clinic, but will also show up under duress in a competitive environment (Wulf 2013).

SUMMARY

In summary, Nevada Physical Therapy and the University of Nevada-Reno Sports Medicine Department hope to advance the "ACL rehabilitation for athletes" conversation by 1) adding a deadlift and eccentric hamstring strength progression model to facilitate hip musculature activation and decrease re-injury risk, 2) establish progressive strength programming consistent with an athlete's demands, 3) utilizing both subjective functional reporting as well as kinesiophobia to guide clinical decision making and 4) establishing an objective RTS testing battery to create a comprehensive athlete profile to maximize potential for full Return to Sport. The goal of this rehab model is to improve the athlete to not only their prior level of function but also beyond it as their pre-existing risk factors need to be identified, addressed and corrected, if able.

The Protocol

One of the primary questions often asked in developing a loading protocol for a patient who has recently had anterior cruciate ligament reconstruction is *how much* should we be protecting the repair versus loading it? There are multiple studies showing that mechanical loading is an important component to establishing tendon or ligament to bone homeostasis, restoring mineral density of the bone complex, stimulating healing, etc. (Wolff et al 1892; Bedi et al 2010). Bedi et al. (2010) investigated the effects of cyclical loading (2% strain x 50 repetitions daily) in surgically repaired ACLs in rats divided into three groups: immediately post-op, 4 days post-op, and 10 days post-op. They found: “At 4 weeks, the group in which delayed loading had been initiated on postoperative day 4 demonstrated a load to failure that was significantly greater than that in all other groups (13.5N +/- 4N vs 8N +/- 4N, p=0.01).” It should be noted that conflicting findings have been found in early loading versus immobilization in other animal tendon studies (Sakai et al 2000; Kamps et al 1994) and, as always, further research is needed. Additionally, several studies have demonstrated that early failure of the graft is often from anchor failure as opposed to mid-substance as demonstrated in another rat study where investigators demonstrated force to failure doubled from 2 weeks to 4 weeks post-operatively (Brophy et al 2011). It seems that, overall, mechanical loading is an important component to stimulate healing of the repaired bone to tendon or ligament site but there is still much that is unknown on what constitutes optimal loading for healing.

While there is very little literature establishing how much (or how little) stress is ideal to stimulate healing in a repaired anterior cruciate ligament, we do have a few dozen studies that have investigated the various forces that occur in the ACL during many rehabilitation tasks. Strain, or the lengthening of the ligament while under load, has been organized per the literature in the infographic on the following page. What is interesting is that almost all non-plyometric movements (i.e. running, jumping, etc.) show a lower strain than seen with level ground walking (Shelbourne et al 1948, Englander et al 2020). It is noteworthy that many of these studies utilized different techniques for establishing strain and stress forces such as 3-D mathematical models, cadaver modeling, motion camera analysis and surgically implanted force transducers which may limit clinical application and should be interpreted cautiously.

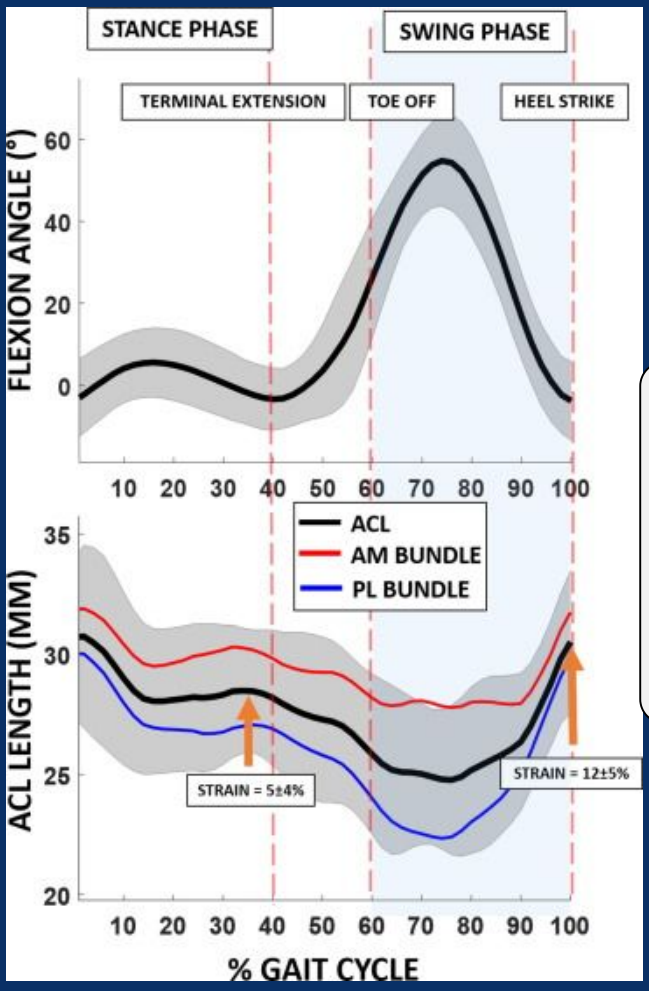
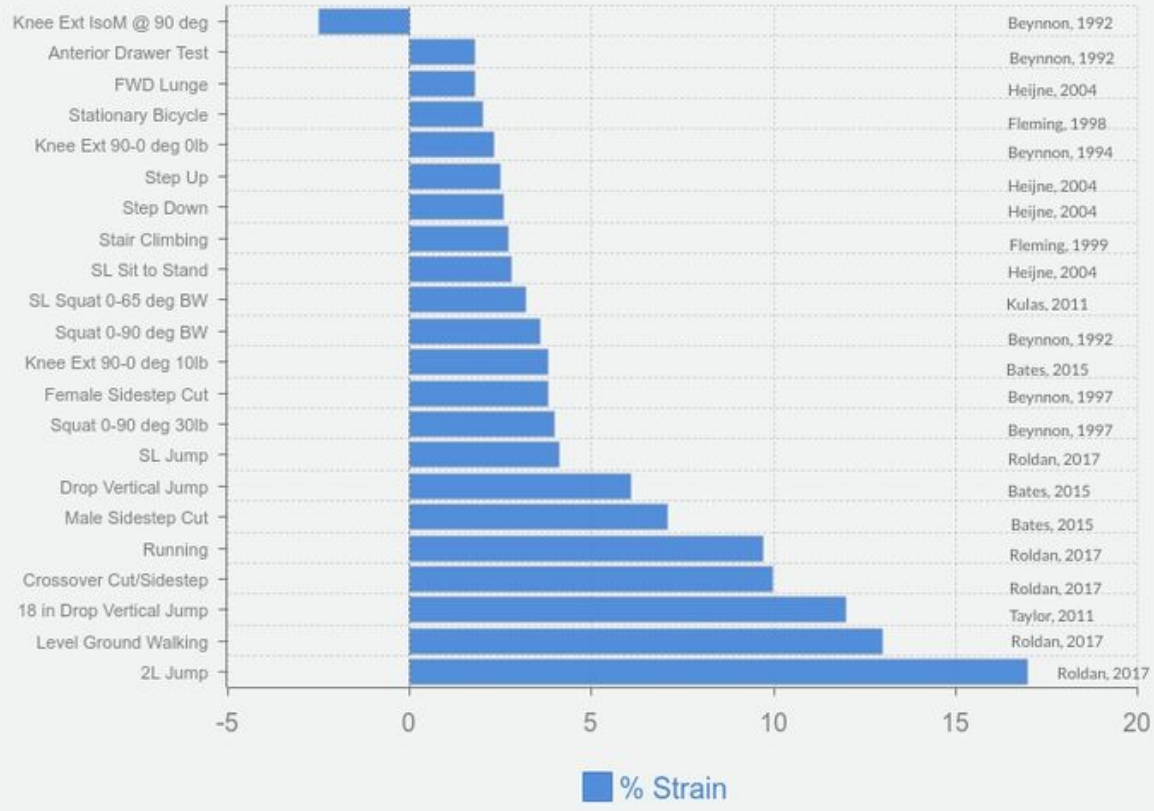


Image source: Englander et al

The Protocol (cont'd)

In specific reference to this protocol, we maintain limited weight bearing for the first two weeks to minimize strain on the repair while the acute inflammatory process associated with surgery resolves. As noted below, (Escamilla et al 2012) we may start OKC exercises such as 90 deg isometrics, 90-45 deg isotonics, etc. within the first two weeks as these appear to create minimal strain on the repair but may be helpful in restoring quad function early on. At two weeks post-surgery we begin loading the knee in closed chain progressions consistent with the current evidence regarding strain profiles. This updated protocol incorporates movements like lunges, wall sits and eccentric leg press early in the post-operative phase in an attempt to minimize quad atrophy and weakness often seen in ACL reconstructed patients while minimizing excessive strain on the healing repair (Birchmieir et al 2019; Gokeler et al 2013).

Strain on the Anterior Cruciate Ligament with Rehabilitation Exercises

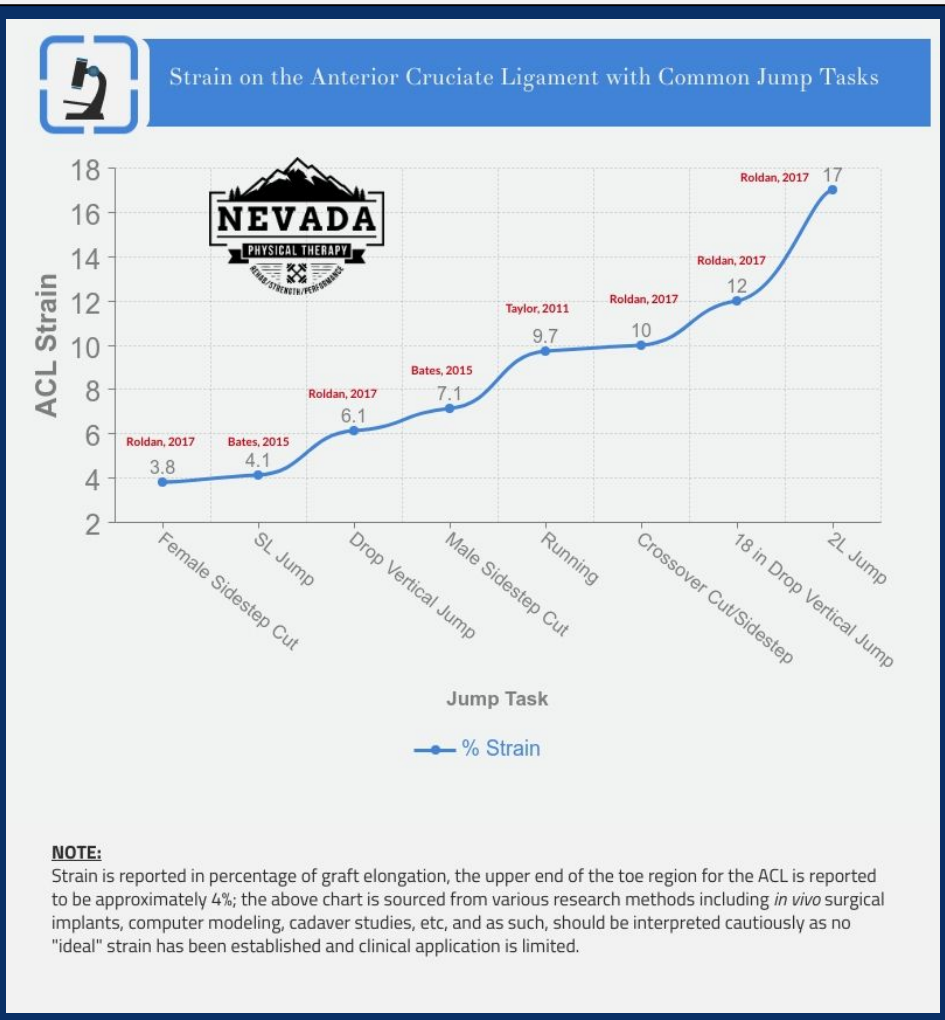


NOTE:
Strain is reported in percentage of graft elongation, the upper end of the toe region for the ACL is reported to be approximately 4%; the above chart is sourced from various research methods including *in vivo* surgical implants, computer modeling, cadaver studies, etc, and as such, should be interpreted cautiously as no "ideal" strain has been established.

The Protocol (cont'd)

The reintroduction of jumping, landing, and change of direction tasks are all imperative for a successful return to sport following an ACL reconstruction. Although there is a paucity of evidence regarding best practices or protocols, this protocol draws on current evidence to address biomechanical, cognitive, and physiologic considerations. Biomechanical considerations include protecting the graft by minimizing strain on it (especially in the early phases), optimizing knee flexion angle, trunk position, and frontal plane mechanics. Physiologic considerations include allowing adequate time for tissue adaptation via initially low volume, incremental progression, and the opportunity to accumulate sport-specific work in the final two blocks.

Note: While these studies are limited by methodological constraints in a similar fashion to the previously mentioned studies on ACL strain, they do allow clinicians to establish an evidence-based protocol when establishing jump skill protocols and progressions. It should be noted, however, that there is limited research from which to draw from and clinical judgment should be exercised. For a detailed breakdown of our jump skill progressions, please see the templates.



NOTE:
Strain is reported in percentage of graft elongation, the upper end of the toe region for the ACL is reported to be approximately 4%; the above chart is sourced from various research methods including *in vivo* surgical implants, computer modeling, cadaver studies, etc, and as such, should be interpreted cautiously as no "ideal" strain has been established and clinical application is limited.

These biomechanical considerations are additionally influenced by focus of attention, e.g. performing a cognitive task while concomitantly performing a drop landing decreased knee flexion at initial contact. (Dai 2017) Frontal plane trunk position during a cutting task is influenced by whether the task is anticipated versus unanticipated. (Houck 2006) Even cueing can influence motor skill execution, retention, and transfer of that skill to novel environments, with external cues preferable to internal cues. (Wulf 2013) In athletes who had previously undergone ACL-R, external cueing (“Push off the ground as hard as you can”) resulted in >30° knee flexion at initial contact & less ground reaction force than the athletes that received an internal cue (Gokeler 2014) and similarly, a 35% increase in knee flexion at ground contact and 23% reduction in ground reaction forces when using external cueing (Favre et al 2016).

The Protocol (cont'd)

External cues can be directed at the environment, or associative in nature, such as encouraging the athlete to replicate a sensation of body position felt during a recent drill. (Wulf 2013) This program utilizes a three-day split, with two days emphasizing higher intensity movements and the third day on lower intensity plyometric movements. In the third and fourth blocks this day is left intentionally blank to accommodate sport-specific drills in order to facilitate accumulation of workload. Dual task and unanticipated work are introduced early, and may be used as a qualitative assessment/criterion for progression

If technique noticeably degrades when cognitive load is increased or unanticipated movements are introduced, that may suggest the athlete needs to spend more time in that block. During the first two blocks, the suggested progression of sets and reps is below the general recommendation of 80-100 foot contacts for session for beginners (Davies 2015) in order to establish tolerance to workload and progress conservatively while also monitoring the athlete for swelling and other adverse symptoms. Athletes must clear the progression criteria to begin the run and jump blocks and additionally, must complete the Run Skill Block before initiating the Return to Running protocol. The Run and Jump Blocks can be reviewed in detail in the Template appendix.

Examples of Cognitive Load

Unanticipated

"After you land, I may or may not toss this ball to you."
"When I drop my arm, step off the box and land they way you've been practicing"

Dual task

"I want you to perform five reps in succession as quickly and accurately as possible while counting backwards by X from the number I give you."

"I'm going to give you a category, and I want you to name as many things in that category as quickly as you can while you perform five quality reps."

<1:5

Less than 20% of protocols used objective criteria for Return to Running decision making- Rambaud et al 2018

Return to Sport

Anterior Cruciate Ligament injuries are one of the most commonly repaired ligaments in the body with an estimated 100-200,000 reconstructions performed each year in the United States. Having surgery does not guarantee a return to prior level of function and those who have suffered an ACL injury, unfortunately also become higher risk for a second injury with 30% of those individuals suffering a contralateral (opposite knee) ACL injury in the first few years post-reconstruction (Grindem et al 2016; Paterno et al 2014) or further, elite athletes can have as high as 50% risk of reinjury in the first postoperative year (Kaeding et al 2017). Understanding the potential contributors to re-injury risk is vital to the rehabilitation process as our goal is to get the individual or athlete back to doing what they love AND mitigating modifiable risk factors for re-injury.

Examples of Non-Modifiable Risk factors

- history of previous injury
- gender
- or age: for example, being younger than 25 years old may increase risk of re-injury up to 23% as found by Wiggins et al. (2016).

19%

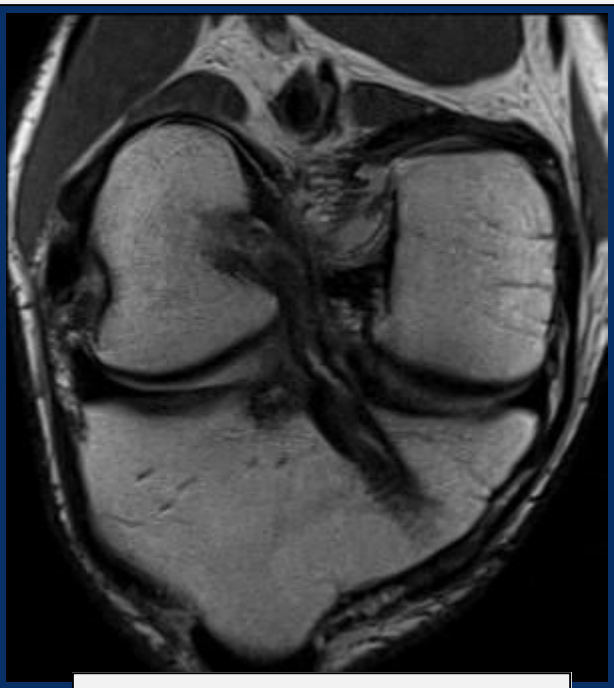
of those that failed to Return to Sport reported fear as the reason

-Ardern et al 2011

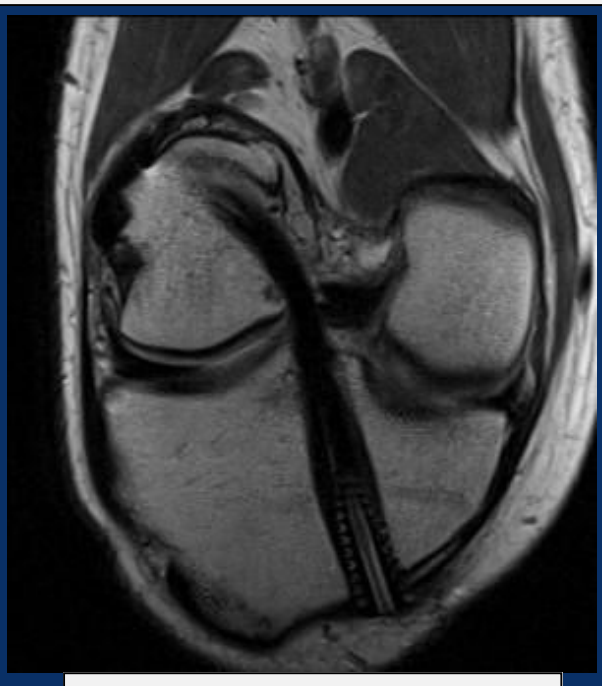
While we cannot change non-modifiable risk factors, we must do our best to address the modifiable contributions to an athlete suffering a second injury and Return to Sport testing (RTS) has become an area of research emphasis recently. This is not meant to address all the known risk factors but instead to add more depth to the Return to Sport conversation for clinicians specifically. An important note before discussing RTS testing: there is no gold standard in place and while we have many promising studies, there are still limitations in study design, populations, etc. and the research must be interpreted both individually and as a cumulative body of knowledge. For example, in this protocol we often reference the Kyritsis et al. (2016) study, which found a 4x higher rate of reinjury for those athletes that did not clear RTS criteria, however the sensitivity (the ability of a test to correctly identify those with the ailment) and specificity (the ability of the test to correctly identify those without the ailment) was only 54% and 79% respectively. Jump testing has been a foundation assessment in RTS testing however this also is not without its criticism as Agel et al. report “this 90% rule is highly questionable because performance tests may be neither demanding nor sensitive enough to accurately identify differences between the injured and non-injured sides” (2016).

Return to Sport (cont'd)

While there are limitations to the current research body, the trends continue to emerge that we need an objective criterion-based assessment to facilitate our decision making process with clearing an athlete to return to play beyond time (32% of medical providers used time ONLY as their criteria and only 13% used an objective criteria-based assessment as described by Barber-Westin and Noyes, 2011). One of the most debated areas in RTS testing is WHEN can the athlete safely return to play? It has been established routinely in the literature that the risk of re-injury is highest in the 6-12 months post-reconstruction (Grindem et al 2016; Kyritsis et al 2016; Schlumberger et al 2015). Grindem et al. additionally demonstrated that for every month after 6 months post-op that we delay an athlete's return to play, the risk of reinjury decreases by 50% up until 9 months (84% total risk reduction) with no significant decrease noted beyond the nine-month mark. Similar to the previously mentioned RTS questions on validity, Capin et al. (2016) demonstrated that of the 14 athletes who cleared RTS testing, the 7 that met their RTS criteria more quickly (6.8 +/- 1.9 months) suffered second ACL injuries compared to those that met their RTS criteria later (9.5 +/1 1.9 months) and did not suffer a second ACL injury. Although a small sample pool, it is compelling information that RTS criteria cannot be used in isolation for clinical decision making in clearing an athlete to return to play. Another important consideration is the athlete's age at the time of reconstruction. Webster et al. published a single-surgeon study showing a 6x higher rate of ipsilateral ACL injury in athletes under 20 years of age compared to controls (2014) with Magnussen et al. (2012) showing a 14.3% reinjury rate in the same age group (compared to 0.7% in those over 20 years of age) and further elaborate that 11 of the 18 reinjuries were in competitive athletes. Additionally, while MRI findings are not well correlated to outcomes when assessing sport readiness, Rabuck et al. (2016) has shown marked MRI signal changes between the 6 and 10-month mark for ACL revascularization.



ACL at 6 months



ACL at 10 months

Image Source: Rabuck et al 2016

Return to Sport (cont'd)

Additionally, Nagelli and Hewett (2017) recently published an article stating that athletes "require a longer postoperative recovery period than the typically advocated 6 to 12 months to facilitate the biological recovery of the joint" with specific attention to bone-bruising which "may be recovering up to one year following ACLR and require a longer recovery period than the standard timeline according to which athletes are returning to activity". Similar to the Rabuck study mentioned above, in regard to ACL revascularization, the researchers cite a study performed by Zaffagnini et al. (2007) that demonstrated the ACL is continuing to remodel up until 24 months after reconstruction and hamstring grafts showing a delayed remodeling phase occurring between 12-24 months in comparison to the 6-12 month timeline seen in patellar tendon autografts (Pauzenberger et al 2013). While it is unlikely that this 24-month timeline argued for by Nagelli and Hewett will be adopted in NCAA and professional athletics until additional research is done on reinjury rates on those delayed to RTS to 24 months, it does highlight that many of the early return to sport decision making criteria may not be in the best interests of the athlete and that healing (and subsequent reduction of reinjury) may be much longer than current industry standards and expectations.

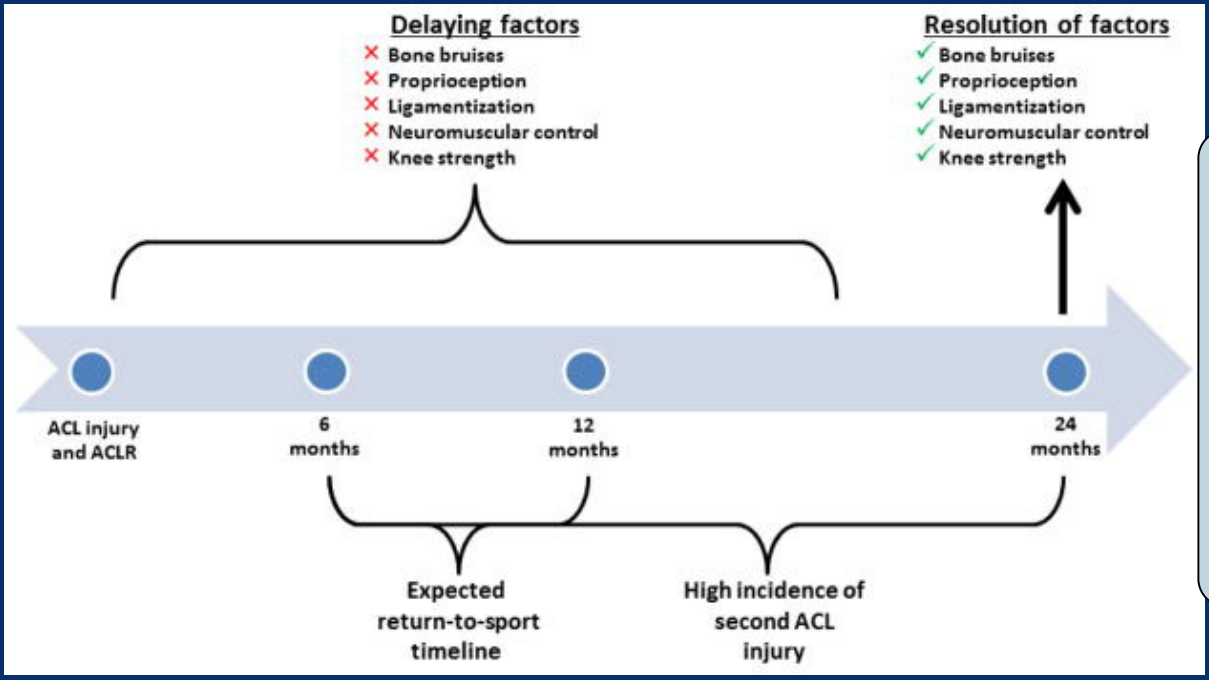


Image Source: Nagelli and Hewett 2017

In conclusion, while there is no consensus on what the criteria should be for Return to Sport testing, the trend in the evidence suggests we need to consider many things to maximize our reduction in an athlete's reinjury risk. At Nevada Physical Therapy, we use a multi-faceted criteria-based test to address multiple areas including subjective readiness, hamstring and quadriceps strength, functional performance such as hop testing, single leg squat, etc. and more. Based off the current best evidence, we believe an athlete should wait until at least 9 months, depending on their age and sport, before being cleared once they have passed all objective testing. While the trend in athletics has been an accelerated 6-month protocol, the current evidence does not support this approach and setting appropriate expectations early in the rehab process is essential.

Return to Sport Testing

1) Quad Girth. PASS/FAIL: Quadriceps girth has been associated with quadriceps function after ACL injury (Kuenze et al 2016)

2) Knee Extension Symmetry (Peak Power, Isometric) **PASS/FAIL**. Decreased quadriceps strength has been associated with increased risk of ACL re-injury as well as linked to poor Return to Sport testing; "QF strength deficits predicted hop test performance beyond the influences of graft type, presence of meniscus injury, knee pain, and knee symptoms." (Paterno et al 2012; Knapik et al 1991)

3) Nordic Hamstring Proficiency (>70 deg), PASS/FAIL: Performance of the Nordic Hamstring Exercise is correlated with eccentric hamstring strength with lower (more open) knee flexion angles demonstrative of higher eccentric strength. Nordic Hamstring Exercise performance has been suggested to reduce ACL risk by improving eccentric HS strength (Monajati et al 2016), a risk factor associated with ligament injury (Myer 2009) as well as increased ACL loading with side-step cutting (Weinhandl et al 2014),

4) Motor Control/Lateral Chain Strength, PASS/FAIL Decreased Single Leg Squat and/or Decreased Side Plank/Lateral Chain Strength may be predictive of ACL re-injury (Hegedus et al. 2016)

5) Quad:Hamstring Ratio, PASS/FAIL Research suggests decreased quadriceps to hamstring strength may be a predictor for ACL re-injury (Knapik et al 1991) and "for every 10% decrease in the hamstring to quadriceps strength ratio there was a 10.6 times higher risk of sustaining an ACL graft rupture (Kyritsis et al 2016)

6) IKDC and Tampa Kinesiophobia Scale, PASS/FAIL. "reduced IKDC score distinguish patients who are unable to return to preinjury sports participation because of fear of reinjury/lack of confidence" (Lentz et al 2015)

7) Single, Triple Hop. PASS/FAIL; Decreased single and triple hop testing is correlated with increased risk of re-injury. (Kyritsis et al 2016) 7) Anterior Y-Balance PASS/FAIL; Athletes who had a greater than 4cm difference in anterior Y-balance scores at 12 weeks were shown to not achieve 90% or greater lower limb symmetry at return to sport testing. (Garrison et al 2015)

8) T-test, PASS/FAIL; Decreased T-test speeds compared to normative data are associated with increased ACL re-injury. (Kyritsis et al 2016)

9) Chronic Workload Established, PASS/FAIL "when an athlete's training and playing load for a given week (acute load) spikes above what they have been doing on average over the past 4 weeks (chronic load), they are more likely to be injured" (Blanch and Gabbett 2015) "tendons are at lowest risk with consistent workloads and susceptible to injury with sudden upgrades in workload" (Orchard et al 2015)

10) Complete Nevada PT Return to Sport Testing, PASS/FAIL. Completing the established Return to Sport Criteria detailed above may decrease re-injury by 84% (Grindem et al 2016) and has been shown to facilitate a 4x reduction in rate of re-injury (Kyritsis et al 2016).

4%

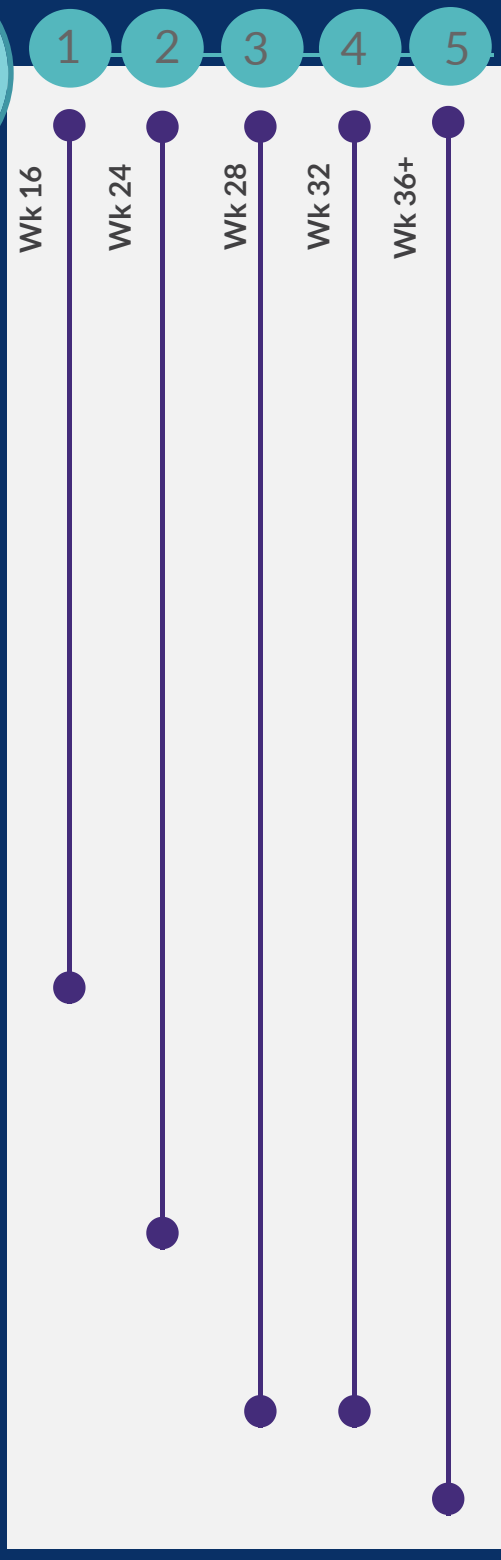
the percentage of protocols using 3 or more objective criteria for RTS; 60% used only one criteria and 38% used only two. -Barber-Westin &Noyes 2011

Return to Sport Timing

NEVADA PHYSICAL THERAPY

IKDC (>95% to clear), TKS-11 @ 6 &9 months
Quad Girth (95% LSI)
ROM (equal to contralateral limb)
KT-1000 Assessment (< 3mm, if > 3mm, delay phase progression by 4 wks)
Quad Isometric Test (95% LSI to clear)
HS Isometric Test (95% LSI to clear, >.6 H:Q to clear for contact)
SL Squat Test (with 10% BW, max reps in 30s, 95% LSI to clear)
SL Squat Test (with 10% BW, max reps in 30s, 95% LSI to clear)
Anterior Y-Balance (less than 4cm difference to clear, 95% LSI to clear)
Peak Power Knee Extension (95% LSI to clear)
Nordic Hamstring Curl (>60 degrees to clear)
Single Hop Test (95% LSI to clear)
Triple Hop Test (95% LSI to clear)
T-test (<9.5s males, <11.0s females to clear)
Chronic Workload(4-week average >70% of Acute or weekly In-season demands to clear)





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Templates (BPTB)

Phase 1A	Week 0-2				
Exercise	**Reps**	**Weight**	**Notes**		
Calf Stretch	3x20 sec	x			
Banded Ankle Series	3x15	banded			Plantarflexion, Dorsiflexion, EV/INV as tol.
HS Stretch	3x20 sec	x			
Quad Sets	10x10 sec	x			Accumulate 50-100 reps per day
Heel/Wall Slides	20T	x			90 deg restriction through week 2
Standing Hip ABD	3-4x10-15	banded			Stand on UNINV side only, banded at knee
Standing Hip EXT	3-4x10-15	banded			Stand on UNINV side only, banded at knee
Overhead Abs	3x10-15	As tol.			Anti-lumbar extension, cue quad
Partial Sit-ups	3x10-15	As tol.			Low back stays in contact on table, cue quad
90 deg Quad ISO	10x5 sec	x			Begin at 7-10 days post-op, Isometric Hold

Precautions

- Infection and Blood Clot Education
- Minimize Excessive Strain on Repair
- Minimize Exceeding Tolerances Which May Increase Inflammation/Pain/Effusion
- Avoid Early Weight-Bearing Progressions if Patient Reports Hyper-extension Moment or Instability

Goals for Phase 1

- Symmetrical Knee Extension PROM by wk 2
- 90 degrees of PROM Flexion by Week 2
- 105-110 degrees PROM Flexion by Wk 3
- Normalized Quad Contraction by Wk 2
- <5 deg Extensor Lag with Straight Leg Raise by Wk 2-3
- Independent Ambulation with Attention to Maintaining Knee Extension with Heel Strike and through Mid-Stance Phase

Phase 1B	Week 3-5			
Exercise	**Reps**	**Weight**	**Start Date**	**Notes**
Heel/Wall Slides	20T	x		100 degrees by wk 3, 115-120 by week 4,etc
HS Stretch	3x20 sec	x		
Overhead Abs	3x10-15	As tol.		Anti-lumbar extension, cue quad
SLR	3-4x10-15	x	Week 2+	Only perform when less than 5 deg ext. lag
Bicycle	7-10 min	x	Week 2+	No resistance
Weight Shifts	5x20 sec	x	Week 2+	Progress to wobble board balance as tol.
Wall Sits	5x15-30 sec	x	Week 3	70 degrees
Mini Squats	3-4x10-15	BW	Week 3	70 degree flexion
Hip Hinge Holds	5x10-20 sec		Week 3	Banded at knees, isometric holds for time
Eccentric Leg Press	3x10-15		Week 3	Light weight, progress reps weekly
Lunges	3x10-15	As tol.	Week 4	FWD, surgical leg in front
Step Ups	30T	BW, 6in	Week 4	
Lateral Agilities	3x60 sec	banded	Week 5	Band at knees, microsteps

Protocol Note: These templates are based off BPTB graft selection and may need to be modified for HS or allograft reconstructions

Templates (cont'd)

Phase 2A	Weeks 5-8				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	4-6" step, add foam as able
Knee Dominant A1	KB Box Squats	3x10-12	Light	3:0:3:0	Light weight, skill acquisition, load tolerance emphasis
Knee Dominant A2	FWD Lunge (INV only)	3x10-12	BW	2:0:2:0	Bodyweight, minimize valgus ("knees not in")
SL Hip Dominant B1	1L RDL	4x8	Light	3:1:1:0	Skill acquisition emphasis
Hip Dominant B2	Step Ups	4x10	x	x	6-10 inches based on tolerance
Accessory B3	1L Press Eccentrics	4x15	Light to moderate	5:0:1:0	
Core	Side Plank	3x20-30s	x	x	

Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**Notes**
Movement Prep	Lateral Agility	3x60 sec	Banded	x	Microsteps, lead with knee not ankle
Movement Prep	Reactive SL RDL	20T	Floor-> Foam	3:1:1:0	Start on floor, progress to foam once skill allows
Hip Dominant A1	KB RDL	3x12-15	Per RIR (18-35lbs)	3:1:1:0	Light weight, skill acquisition, load tolerance emphasis
Hip Dominant A2	2L Bridge	3x10	BW	x	Add 2 reps per week
SL Knee Dominant B1	1L Press Eccentrics	4x15	Light to Moderate	5:0:1:0	Per tempo
Knee Dominant B2	Wall Sits	5x20 sec	Light to Moderate	x	Can add weight once able to complete 5x30 sec easily
Accessory B3	KB 1A Rows	4x10 ea	Per RIR	x	Hip Hinge Position
Core	Front Plank	3x20-30s		x	

Goals for Phase 2

- Accumulate Skill and Tolerance to Squat and Hip Hinge Variations
- Establish 2-day Split to Facilitate Future Intensity Progressions
- PROM Knee Flexion to >120 Degrees
- Introduce Reactive/Neuromuscular Progressions
- Introduce Tempo and Reps in Reserve Comprehension/Application

Week 9	**Phase 2B Weeks 9-12**					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	KB Squats	3x10-12	Moderate	3:0:1:0	x	DBL KB in front rack position
Knee Dominant A2	FWD Lunge (INV only)	4x12	Moderate	2:0:2:0	x	Per tempo
SL Hip Dominant B1	1L RDL	4x8	Moderate	3:1:1:0	x	
Hip Dominant B2	1L Bridge	4x10	Light	x	x	2L bridge regression if painful
Accessory B3	1L Leg Press Eccentrics	4x15	Moderate	5:0:0:0	x	per tempo
Core	Side Plank	4x20sec	x	x	x	
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	DBL KB RDL	3x10-12	Moderate	3:0:1:0	x	
Hip Dominant A2	Frog Bridge	4x12	Moderate	x	x	Weighted or Banded as Needed
SL Knee Dominant B1	1L KB Step Ups	3x15	Moderate	3:0:0:0	x	12" height, slow eccentric
Knee Accessory B2	Prone HS Curls	2x10/10/10	VERY light	3:1:1:0	x	10 both legs, 10 ea (30T) per set, control end range
Accessory B3	1L Squats (ECC)	20T	BW	3:0:1:0	x	1L down, 2L up, to 70 deg box or as tolerated
Core	Front Plank	4x20sec	x	x	3	
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	KB Squats	3x12	Moderate	3:0:1:0	x	DBL KB in front rack position
Knee Dominant A2	FWD Lunge (INV only)	4x12	Moderate	2:0:2:0	x	Per tempo
SL Hip Dominant B1	1L RDL	4x8	Moderate	3:1:1:0	x	
Hip Dominant B2	1L Bridge	4x10	Light	x	x	2L bridge regression if painful
Accessory B3	1L Leg Press Eccentrics	4x15	Moderate	5:0:0:0	x	per tempo
Core	Side Plank	4x20sec	x	x	3	

Templates (cont'd)

Week 10	Phase 2B Weeks 9-12					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	DBL KB RDL	4x12-15	Per RIR	3:0:1:0	5	
Hip Dominant A2	Frog Bridge	3x20	Per RIR	x	5	Weighted or Banded as Needed
SL Knee Dominant B1	1L KB Step Ups	4x10	Per RIR	3:0:0:0	5	12" height, slow eccentric
Knee Accessory B2	Prone HS Curls	2x10/10/10	VERY light	3:1:1:0	x	10 both legs, 10 ea (30T) per set, control end range
Accessory B3	1L Squats (ECC)	3x10	BW	3:0:1:0	5	1L down, 2L up to 70 deg box or as tolerated
Core	Front Plank	4x30sec	x	x	3	
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	KB Squats	4x8	Per RIR	3:0:1:0	5	DBL KB (neutral position)
Knee Dominant A2	FWD Lunge (INV only)	4x15	Per RIR	2:0:2:0	5	Per tempo
SL Hip Dominant B1	1L RDL	4x8	Per RIR	3:1:1:0	5	
Hip Dominant B2	1L Bridge	4x10	Per RIR	x	x	2L bridge regression if painful
Accessory B3	1L Leg Press Eccentrics	4x15	Per RIR	5:0:0:0	5	per tempo
Core	Side Plank	4x30sec	x	x	3	
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	DBL KB RDL	4x12-14	Per RIR	3:0:1:0	5	
Hip Dominant A2	Frog Bridge	4x12	Per RIR	x	5	Weighted or Banded as Needed
SL Knee Dominant B1	1L KB Step Ups	4x10	Per RIR	3:0:0:0	5	12" height, slow eccentric
Knee Accessory B2	Prone HS Curls	2x10/10/10	VERY light	3:1:1:0	x	10 both legs, 10 ea (30T) per set, control end range
Accessory B3	1L Squats (ECC)	12/10/8	Light	3:0:1:0	5	10% BW maximum, 1L down 2L up to 70 deg box
Core	Front Plank	4x30sec	x	x	3	

Week 11	Phase 2B Weeks 9-12					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	KB Squats	4x6	Per RIR	3:0:1:0	5	
Knee Dominant A2	FWD Lunge (INV only)	4x15	Per RIR	2:0:2:0	5	Per tempo
SL Hip Dominant B1	1L RDL	4x8	Per RIR	3:1:1:0	5	
Hip Dominant B2	1L Bridge	3x15	Per RIR	x	5	2L bridge regression if painful
Accessory B3	1L Leg Press Eccentrics	4x12	Per RIR	5:0:0:0	5	per tempo
Core	Side Plank	4x45sec	x	x	3	
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	BB RDL	4x12	Per RIR	3:0:1:0	5	
Hip Dominant A2	1L Hip Thrusters	4x15	Per RIR	x	5	Weighted or Banded as Needed, ALTERNATE EX: 1L elvated bridge if painful or exceedingly difficult
SL Knee Dominant B1	1L KB Step Ups	4x8	Per RIR	3:0:0:0	5	12" height, slow eccentric
Knee Accessory B2	Prone HS Curls	2x10/10/10	VERY light	3:1:1:0	x	10 both legs, 10 ea (30T) per set, control end range
Accessory B3	1L Squats (ECC)	12/10/8	Light	3:0:1:0	5	10% BW maximum, 1L down 2L up to 70 deg box
Core	Front Plank	4x45sec	x	x	3	
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	KB Squats	12/10/8/6	Per RIR	3:0:1:0	5	Weight progressed per ladder per RIR
Knee Dominant A2	FWD Lunge (INV only)	4x15	Per RIR	2:0:2:0	5	Per tempo
SL Hip Dominant B1	1L RDL	4x8	Per RIR	3:1:1:0	5	
Hip Dominant B2	1L Bridge	3x15	Per RIR	x	5	2L bridge regression if painful
Accessory B3	1L Leg Press Eccentrics	4x12	Per RIR	5:0:0:0	5	per tempo
Core	Side Plank	4x45sec	x	x	3	

Templates (cont'd)

Week 12	Phase 2B Weeks 9-12					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	BB RDL	12/10/8/6	Per RIR	3:0:1:0	4	RIR for last two sets, skill emphasis
Hip Dominant A2	1L Hip Thrusters	4x15	Per RIR	x	4	Weighted or Banded as Needed, ALTERNATE EX: 1L elvated bridge if painful or exceedingly difficult
SL Knee Dominant B1	1L KB Step Ups	4x8-10	Per RIR	3:0:0:0	4	12" height, slow eccentric
Knee Accessory B2	Prone HS Curls	2x10/10/10	Per RIR	3:1:1:0	4-5	10 both legs, 10 ea (30T) per set, control end range
Accessory B3	1L Squats (ECC)	4x8	10-15% BW	3:0:1:0	3	1L down, 2L up, to 70 deg box or lower
Core	Front Plank	4x60sec	x	x	3	
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	BB Back Squats	3x10	Light/Mod	3:0:1:0	4	Skill Acquisition Emphasis
Knee Dominant A2	FWD Lunge (INV only)	4x12	Per RIR	2:0:2:0	3	Per tempo
SL Hip Dominant B1	1L RDL	4x10	Per RIR	3:1:1:0	3-4	
Hip Dominant B2	1L Bridge	4x15	Per RIR	x	3	2L bridge regression if painful
Accessory B3	1L Leg Press Eccentrics	4x15	Per RIR	5:0:0:0	3	per tempo
Core	Side Plank	4x60sec	x	x	3	
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Domimant A1	BB RDL	4x10	Per RIR	3:0:1:0	4	RIR for last two sets, skill emphasis
Hip Dominant A2	1L Hip Thrusters	4x15	Per RIR	x	4	Weighted or Banded as Needed, ALTERNATE EX: 1L elvated bridge if painful or exceedingly difficult
SL Knee Dominant B1	1L KB Step Ups	4x8-10	Per RIR	3:0:0:0	4	12" height, slow eccentric
Knee Accessory B2	Prone HS Curls	2x10/10/10	Per RIR	3:1:1:0	4	10 both legs, 10 ea (30T) per set, control end range
Accessory B3	1L Squats (ECC)	4x8	10-15% BW	3:0:1:0	3	1L down, 2L up, to 70 deg box or lower
Core	Front Plank	4x60sec	x	x	3	

Week 13	Phase 3 Weeks (13-16)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band, Ball Toss
Knee Dominant A1	BB Back Squats	4x12	Per RIR	2:0:1:0	4	Minimize weight shift, monitor valgus moment
Knee Dominant A2	FWD Lunge (INV only)	4x12	Per RIR	2:0:2:0	3	Per tempo
Hip Dominant B1	1L KB RDL	5x15	Per RIR	3:1:1:0	3	Volume emphasis
Hip Dominant B2	1L Hip Thruster	4x15	Per RIR	3:0:0:0	x	Elevated 1L Bridge if painful
Accessory B3	Standing Pallof	3x15	Per RIR	x	2-3	Bilateral
Core	Side Plank Hip ABD	3x10	x	x	3	Reps per side
Run Prep	Block 1 Day 1					
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	Elevated Deadlifts	5x5	Per RIR	3:0:1:0	4-5	4-6 inch elevation, Skill Acquisition, note tempo
Hip Dominant A2	KB RDL	4x15	Per RIR	2:1:2:0	2-3	Volume/Hypertrophy emphasis
Knee Dominant B1	1L Squats	20T	Per RIR	3:0:0:0	x	70 deg, skill acquisition emphasis
Knee Dominant B2	Nordic HS Curls	2x5	Per RIR	3:1:1:0	x	Max effort, control for break angle, no CONC
Accessory B3	Knee Extensions	4x10	Light	5:0:0:0	4-5	Light weight, pain-free emphasis
Core	Front Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band, Ball Toss
Knee Dominant A1	BB Back Squats	4x10	Per RIR	2:0:1:0	4	DBL KB in front rack position
Knee Dominant A2	1L Step Ups	5x10	Per RIR	2:0:2:0	2-3	Per tempo
Hip Dominant B1	1L KB RDL	5x15	Per RIR	3:1:1:0	2-3	
Hip Dominant B2	1L Hip Thruster	4x15	Per RIR	x	x	Elevated 1L Bridge if painful
Accessory B3	Standing Pallof	3x15	Per RIR	x	2-3	Bilateral
Core	Side Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 3					

Templates (cont'd)

Progression Criteria to Begin Run/Jump Blocks

- Symmetrical Knee Extension PROM
- >130 deg Knee Flexion PROM
- Minimal to No Joint Effusion
- No Subjective Complaint of Buckling or Instability
- >70% LSI Q:Q Isometric Testing with Handheld Dynamometer
- >70% LSI Single Leg Squat Test
- >70% LSI Side Plank Hib Abduction Testing
- 3mm or Less Anterior Tibial Laxity as Measured with KT-1000

Run Block 1

Day 1		Day 2		Day 3		Notes
Lateral Squat Holds	5x10 sec holds, microsteps in/out	**Banded Box March**	3 laps x 3-5 sets, microsteps	**Posterior Banded March**	5x15 sec, skill emphasis	**Skill emphasis, focus on heel drive and knee extension with contralateral hip, knee, ankle flexion. Start at 50% intensity and progress 10% per week.**
Wall March Triple Flexion	3x10 ea, cue heel drive	**Triple Flexion Sled Push**	15M, heel drive and skill emphasis	**Lean Starts x Triple Step**	Heel raise, forward lean, 3 step decel	

Week 14	Phase 3 Weeks (13-16)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band, Ball Toss
Hip Dominant A1	Elevated Deadlifts	4x8	Per RIR	3:0:1:0	4	4-6in elevation, Skill Acquisition emphasis
Hip Dominant A2	BB RDL	4x12+	Per RIR	2:0:2:0	2-3	Last set to 1 RIR
Knee Dominant B1	1L Squats	3x10	10% BW	3:1:1:0	3	10% BW external load
Knee Dominant B2	Nordic HS Curls	3x5	X	x	x	Max effort, control for break angle, no CONC
Accessory B3	Knee Extensions	4x12+	Light	x	4-5	Light weight, pain-free emphasis, last set to 1 RIR
Core	Side Plank	3x10	x	x	3	reps per side
Run Prep	Block 1 Day 1					
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band, Ball Toss
Knee Dominant A1	BB Back Squats	4x8	Per RIR	2:0:1:0	3	DBL KB in front rack position
Knee Dominant A2	1L Step Ups	5x10	Per RIR	2:0:2:0	2-3	Per tempo
Hip Dominant B1	1L KB RDL	5x15	Per RIR	3:1:1:0	2-3	
Hip Dominant B2	1L Hip Thrusters	4x15	Per RIR	3:0:1:0	x	Elevated 1L Bridge if painful
Accessory B3	Standing Pallof	3x15	Per RIR	x	2-3	Bilateral
Core	Front Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agility	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band, Ball Toss
Hip Dominant A1	Elevated Deadlifts	4x8	Per RIR	3:0:1:0	3	4-6in elevation, Skill Acquisition emphasis
Hip Dominant A2	BB RDL	4x12+	Per RIR	2:0:2:0	2-3	Last set to 1 RIR
Knee Dominant B1	1L Squats	3x12	10% BW	3:1:1:0	3	10% BW external load
Knee Dominant B2	Nordic HS Curls	3x5	x	x	x	Max effort, control for break angle, no CONC
Accessory B3	Knee Extensions	4x10	Moderate	x	2-3	per tempo
Core	Side Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 3					

Templates (cont'd)

Week 15	Phase 3 Weeks (13-16)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agility	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	BB Back Squats	4x8	Per RIR	3:0:1:0	3	DBL KB in front rack position
Knee Dominant A2	FWD Lunge (INV only)	4x12	Per RIR	2:0:2:0	2-3	Per tempo
Hip Dominant B1	Prone HS Curls	4x	Per RIR	3:1:1:0	2-3	
Hip Dominant B2	1L Hip Thrusters	4x15	Per RIR	x	x	Elevated 1L Bridge if painful
Accessory B3	Standing Pallof	3x15	Per RIR	x	2-3	Bilateral
Core	Side Plank	3x12	x	x	3	reps per side
Run Prep	Block 1 Day 1	**Jump Prep**	Block 1 Day 1			
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	BB Deadlifts	5x5	Per RIR	3:0:1:0	4-5	Skill Acquisition, note tempo
Hip Dominant A2	KB RDL	4x15	Per RIR	2:1:2:0	2-3	Volume/Hypertrophy emphasis
Knee Dominant B1	1L KB Step Ups	4x8-10	Per RIR	2:0:2:0	2-3	12" height, slow eccentric
Knee Dominant B2	Nordic HS Curls	3x6	Per RIR	3:0:0:0	2-3	Max effort, control for break angle, no CONC
Accessory B3	1L Squats	4x10	Per RIR	3:0:1:0	2-3	
Core	Front Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 2	**Jump Prep**	Block 1 Day 2			
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	BB Back Squats	5x6	Per RIR	3:0:1:0	3	DBL KB in front rack position
Knee Dominant A2	1L Squat to Box	5x10	Per RIR	2:0:2:0	2-3	Per tempo
Hip Dominant B1	1L Hip Thrusters	5x15	Per RIR	3:1:1:0	2-3	
Hip Dominant B2	Prone HS Curls	4x15	Per RIR	x	x	Elevated 1L Bridge if painful
Accessory B3	Standing Pallof	3x15	Per RIR	x	2-3	Bilateral
Core	Side Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 3	**Jump Prep**	Block 1 Day 3			

Jump Block 1

Day 1: Knee Flexion		Day 2: Force Production		Day 3: Accumulate Volume at Low Intensity		Volume Tracking	(*) Starred Exercises, each session	Total Session Foot Contacts
CM SL Chair Sticks*	Constrained for knee flex > 30 deg*	**NCM Jump Up***	Force production, gravity reduced	**Ladder**	Low intensity multidirectional	**Week 1**	4x5	40/60
Mini Lunge Jumps (ACL-R fwd only)* w/ dual task if consistently no valgus	Decel; low strain profile	**Lateral DL Jump Up**	Frontal Plane, gravity reduced	**Side Shuffle**	Low intensity frontal plane	**Week 2**	4x6	48/72
2-->1 drop from floor w/ ball catch*	Decel + unanticipated perturbation	**Wall March Triple Flexion**	Isometric skill work	**Line Hops**	Low intensity DL	**Week 3**	6x5	60/90

Author Note:

A unique component of this protocol is our intentional delay of running and jumping. While many bring these activities in at 12-16 weeks, we are of the opinion that the increased strain on the repair is unnecessary and have anecdotally find more value in continuing strength progressions while focusing on pre-jump and run skill acquisition through this phase.

Templates (cont'd)

Week 16	Phase 3 Weeks (13-16)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	BB Deadlifts	5x5	Per RIR	3:0:1:0	4-5	Skill Acquisition, note tempo
Hip Dominant A2	KB RDL	4x15	Per RIR	2:1:2:0	2-3	Volume/Hypertrophy emphasis
Knee Dominant B1	1L KB Step Ups	4x8-10	Per RIR	3:0:0:0	2-3	12" height, slow eccentric
Knee Dominant B2	Nordic HS Curls	3x6	Per RIR	3:1:1:0	2-3	Max effort, control for break angle, no CONC
Accessory B3	1L Leg Press Eccentrics	4x10	Per RIR	5:0:0:0	2-3	
Core	Front Plank	10x10 sec	x	x	3	Max effort, pull elbows to knees (isometric) RKC style
Run Prep	Block 1 Day 1	**Jump Prep**	Block 1 Day 1			
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Movement Prep	Reactive Step Downs	20T	See Notes	3:0:0:0	x	6 in, Foam, Valgus Band as able
Knee Dominant A1	BB Back Squats	4x8	Per RIR	3:0:1:0	3	DBL KB in front rack position
Knee Dominant A2	1L Squat to Box	5x10	Per RIR	2:0:2:0	2-3	Per tempo
Hip Dominant B1	1L Hip Thrusters	5x15	Per RIR	3:1:1:0	2-3	Elevated 1L Bridge if painful
Hip Dominant B2	Prone HS Curls	4x15	Per RIR	x	2-3	Note RIR, control end range
Accessory B3	Standing Pallof	3x15	Per RIR	x	2-3	Bilateral
Core	Side Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 2	**Jump Prep**	Block 1 Day 2			
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	Reactive SL RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Hip Dominant A1	BB Deadlifts	5x5	Per RIR	3:0:1:0	4-5	Skill Acquisition, note tempo
Hip Dominant A2	KB RDL	4x15	Per RIR	2:1:2:0	2-3	Volume/Hypertrophy emphasis
Knee Dominant B1	1L KB Step Ups	4x8-10	Per RIR	3:0:0:0	2-3	12" height, slow eccentric
Knee Dominant B2	Nordic HS Curls	3x6	Per RIR	3:1:1:0	2-3	Max effort, control for break angle, no CONC
Accessory B3	1L Leg Press Eccentrics	4x10	Per RIR	5:0:0:0	2-3	
Core	Front Plank	4x60sec	x	x	3	
Run Prep	Block 1 Day 3	**Jump Prep**	Block 1 Day 3			

RTS Block 1

Run Block 2

Day 1		Day 2		Day 3	
Triple Flexion Glute Tap	5x10 sec	**Sled Push 15M**	6 rounds, 10% Intensity added ea wk	**Banded March (Intensity)**	6x15 sec
6" Step-Up Hip Drive	Step and Drive, 5x10 ea	**Ball Push March**	5x12 ea	**Lunge Bounding**	3x15M

Jump Block 2

Day 1: SL Decel		Day 2: Force Production, Frontal Plane		Day 3		Volume Tracking	(*) Starred Exercises, each session	Total Session Foot Contacts
4-8" SL Drop and Stick w/ ball toss	Decel + unanticipated perturbation	**NCM Jump Up 2-->1***	Progression, gravity-reduced	**Ladder**	Low intensity, multi-directional	**Week 1**	4x6	72
Mini Lunge Jumps, both legs if > 4mo; w/ dual task if consistently no valgus	Decel, progression	**Baby Skater Hops (stick it)**	Frontal plane, decel/accel (ea leg)	**Side Shuffle/ Angled backpedal**	Low intensity, multi-directional	**Week 2**	5x6	90
2--> 1 --> 2 Drop + Hop	Decel --> force production	**1L-->2L**	Force absorption/ production	**SL Line Hops**	Low intensity SL	**Week 3**	6x6	108

Templates (cont'd)

Week 17		Phase 4 (weeks 17-20)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	Optional: Nerve Glides, glute med/min roll out
Movement Prep	1L Reactive RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Primary Pull	BB Deadlifts	See Note	Per RIR	3:1:1:1	2	1x8 @ 8 (2RIR), drop 15% 2x8
Primary Push	Bilateral Lunges	3x10	Per RIR	2:1:2:1	4	Note tempo, reps per side
Pull Accessory	1L RDLs	4x15	Per RIR	3:1:1:0	4	Volume emphasis
Core	Front Plank	4x60sec	x	x	3	Weighted or Banded as Needed
Quadriceps	Knee Extensions	4x15+			2	Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Nordic HS Curls	3x8	Per RIR	x	2-3	
Skill Work	**Run Skill**	Block 2 Day 1	**Jump Skill**	Block 2 Day 1		

Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	Optional: Quad Foam Roll, Hip IR stretch
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	x	Foam, valgus band, ball toss
Primary Push	BB Back Squats	See Note	Per RIR	2:1:1:0	2-3	1x10 @ 8 (2RIR), drop 15% 2x10
Primary Pull	BB RDLs	3x10	Per RIR	3:0:1:0	4	Eccentric emphasis, note RIR
Push Accessory	1L Step Ups	4x8-10	Per RIR	2:0:2:0	2-3	Box just below knee height, KB front rack position
Core	Side Plank w Hip ABD	5x15 ea	0	x	2	Perform leg lifts per rep scheme or max able per set
Quadriceps	Knee Extensions	4x15+	Moderate	x	2-3	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Prone HS Curls	4x15+	Per RIR	3:1:1:0	4	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Skill Work	**Run Skill**	Block 2 Day 2	**Jump Skill**	Block 2 Day 2		

Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	1L Reactive RDLs	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Primary Pull	BB Deadlifts	See Note	Per RIR	3:1:1:1	2-3	1x6 @ 8 (2RIR), drop 15% 3x6
Primary Push	Bilateral Lunges	3x10	Per RIR	2:1:2:1	2-3	Note tempo, reps per side
Pull Accessory	1L RDLs	4x15	Per RIR	3:1:1:0	4	Volume emphasis
Core	Front Plank	10x10sec	x	x	3	Max effort RKC style Planks
Quadriceps	Knee Extensions	4x15+	x	x	2	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Nordic HS Curls	3x8	x	x	x	
Skill Work	**Run Skill**	Block 2 Day 3	**Jump Skill**	Block 2 Day 3		

Week 18		Phase 4 (weeks 17-20)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	Optional: Quad Foam Roll, Hip IR stretch
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	x	Foam, valgus band, ball toss
Primary Push	BB Back Squats	See Note	Per RIR	2:1:1:0	2-3	1x8 @ 8 (2RIR), drop 15% 3x8
Primary Pull	BB RDLs	3x10	Per RIR	3:0:1:0	4	Eccentric emphasis, note RIR
Push Accessory	1L Step Ups	4x8-10	Per RIR	2:0:2:0	2-3	Box just below knee height, KB front rack position
Core	Side Plank w Hip ABD	5x15 ea	0	x	2	Perform leg lifts per rep scheme or max able per set
Quadriceps	Knee Extensions	4x15+	Moderate	x	2-3	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Prone HS Curls	4x15+	Per RIR	3:1:1:0	4	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Skill Work	**Run Skill**	Block 2 Day 1	**Jump Skill**	Block 2 Day 1		

Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	1L Reactive RDLs	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Primary Pull	BB Deadlifts	See Note	Per RIR	3:1:1:1	2-3	1x5 @ 8 (2RIR), drop 15% 4x5
Primary Push	Bilateral Lunges	3x10	Per RIR	2:1:2:1	2-3	Note tempo, reps per side
Pull Accessory	1L RDLs	4x15	Per RIR	3:1:1:0	4	Volume emphasis
Core	Front Plank	4x60sec	x	x	3	Weighted or Banded as Needed
Quadriceps	Knee Extensions	4x15+	x	x	2	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Nordic HS Curls	3x8	x	x	x	
Skill Work	**Run Skill**	Block 2 Day 2	**Jump Skill**	Block 2 Day 2		

Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	Optional: Quad Foam Roll, Hip IR stretch
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	x	Foam, valgus band, ball toss
Primary Push	BB Back Squats	See Note	Per RIR	2:1:1:0	2-3	1x6 @ 8 (2RIR), drop 15% 4x6
Primary Pull	BB RDLs	3x10	Per RIR	3:0:1:0	4	Eccentric emphasis, note RIR
Push Accessory	1L Step Ups	4x8-10	Per RIR	2:0:2:0	2-3	Box just below knee height, KB front rack position
Core	Side Plank w Hip ABD	5x15 ea	0	x	2	Perform leg lifts per rep scheme or max able per set
Quadriceps	Knee Extensions	4x15+	Moderate	x	2-3	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Prone HS Curls	4x15+	Per RIR	3:1:1:0	4	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Skill Work	**Run Skill**	Block 2 Day 3	**Jump Skill**	Block 2 Day 3		

Templates (cont'd)

Week 19		Phase 4 (weeks 17-20)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	Optional: Nerve Glides, glute med/min roll out
Movement Prep	1L Reactive RDL	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Primary Pull	BB Deadlifts	See Note	Per RIR	3:1:1:1	2	1x4 @8.5 drop 15%, 4x4
Primary Push	Bilateral Lunges	3x15-20	Per RIR	2:1:2:1	3	Note tempo, reps per side
Pull Accessory	1L RDLs	4x15	Per RIR	3:1:1:0	4	Volume emphasis
Core	Front Plank	10x10 sec	x	x	3	Max effort RKC style Planks
Quadriceps	Knee Extensions	4x15+			2	Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Nordic HS Curls	3x8	Per RIR	x	2-3	
Skill Work	**Run Skill**	RTR	**Jump Skill**	Block 2 Day 1		Return to Running Protocol

Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	Optional: Quad Foam Roll, Hip IR stretch
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	x	Foam, valgus band, ball toss
Primary Push	BB Back Squats	See Note	Per RIR	2:1:1:0	1-2	1x5 @ 8 (2RIR), drop 15% 5x5
Primary Pull	BB RDLs	4x8	Per RIR	3:0:1:0	4	Eccentric emphasis, note RIR
Push Accessory	1L Step Ups	4x10-12	Per RIR	2:0:2:0	2-3	Box just below knee height, KB front rack position
Core	Side Plank w Hip ABD	5x15 ea	0	x	2	Perform leg lifts per rep scheme or max able per set
Quadriceps	Knee Extensions	4x15+	Moderate	x	2-3	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Prone HS Curls	4x15+	Per RIR	3:1:1:0	4	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Skill Work	**Run Skill**	RTR	**Jump Skill**	Block 2 Day 2		Return to Running Protocol

Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	1L Reactive RDLs	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Primary Pull	BB Deadlifts	See Note	Per RIR	3:1:1:1	2	1x3, drop 15% 5x3
Primary Push	Bilateral Lunges	4x10	Per RIR	2:1:2:1	2-3	Note tempo, reps per side
Pull Accessory	1L RDLs	4x15	Per RIR	3:1:1:0	4	Volume emphasis
Core	Front Plank	4x60sec	x	x	3	Weighted or Banded as Needed
Quadriceps	Knee Extensions	4x15+	x	x	2	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Nordic HS Curls	3x8	x	x	x	
Skill Work	**Run Skill**	RTR	**Jump Skill**	Block 2 Day 3		Return to Running Protocol

Week 20		Phase 4 (weeks 17-20)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	Optional: Quad Foam Roll, Hip IR stretch
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	x	Foam, valgus band, ball toss
Primary Push	BB Back Squats	See Note	Per RIR	2:1:1:0	2-3	1x3 @ 8 (2RIR), drop 15% 5x3
Primary Pull	BB RDLs	3x8-10	Per RIR	3:0:1:0	3	Eccentric emphasis, note RIR
Push Accessory	1L Step Ups	4x8-10	Per RIR	2:0:2:0	2-3	Box just below knee height, KB front rack position
Core	Side Plank w Hip ABD	5x15 ea	0	x	2	Perform leg lifts per rep scheme or max able per set
Quadriceps	Knee Extensions	4x15+	Moderate	x	2-3	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Prone HS Curls	4x15+	Per RIR	3:1:1:0	4	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Skill Work	**Run Skill**	RTR	**Jump Skill**	Block 2 Day 1		Return to Running Protocol

Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Movement Prep	1L Reactive RDLs	20T	6" + foam	3:0:0:0	x	On foam, add cone tap when able
Primary Pull	BB Deadlifts	2x8	Per RIR	3:1:1:1	4	**Deload, Note RIR**
Primary Push	Bilateral Lunges	2x10	Per RIR	2:1:2:1	3	Note tempo, reps per side
Pull Accessory	1L RDLs	2x15	Per RIR	3:1:1:0	4	Volume emphasis
Core	Front Plank	10x10 sec	x	x	3	Max effort RKC style Planks
Quadriceps	Knee Extensions	4x15+	x	x	2	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Nordic HS Curls	3x8	x	x	x	
Skill Work	**Run Skill**	RTR	**Jump Skill**	Block 2 Day 2		Return to Running Protocol

Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	Optional: Quad Foam Roll, Hip IR stretch
Movement Prep	Reactive Step Downs	20T	6" + foam	3:0:0:0	x	Foam, valgus band, ball toss
Primary Push	BB Back Squats	2x10	Per RIR	2:1:1:0	3-4	**Deload, Note RIR**
Primary Pull	BB RDLs	3x8	Per RIR	3:0:1:0	4	Eccentric emphasis, note RIR
Push Accessory	1L Step Ups	4x8-10	Per RIR	2:0:2:0	2-3	Box just below knee height, KB front rack position
Core	Side Plank w Hip ABD	5x15 ea	0	x	2	Perform leg lifts per rep scheme or max able per set
Quadriceps	Knee Extensions	4x15+	Moderate	x	2-3	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Hamstrings	Prone HS Curls	4x15+	Per RIR	3:1:1:0	4	Minimum of 12 reps, Final set to RPE 8 (2 Reps in Reserve)
Skill Work	**Run Skill**	RTR	**Jump Skill**	Block 2 Day 3		Return to Running Protocol

Templates (cont'd)

Day 1: Deceleration		Day 2: Decel-Acceleration		Day 3: Workload accumulation/ COD	
Drop to DL Hurdle Hop (med/lat/fwd)	Decel --> COD	**DL drop to jump up**	Reduce GCT, decrease intensity of second landing. Can add dual task	**4 Cone Drill, low-med effort**	Workload accumulation; Intro to COD
1L-->1L	Decel-> 1L tasks	**Skater hops with fwd progression**	Frontal plane + sag. decel	**T-Test low- med effort**	Workload accumulation; Intro to COD
Drop to angled cut	Decel --> Accel	**Jog to DL decel & stick**	Higher demand Decel skill	**Sport Skills, anticipated only, low intensity**	Workload accumulation; Intro to COD

Month 5-6				Phase 5 (Weeks 21-24)		
Week 21	**Phase 5 (Weeks 21-24)**					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec				
Push	BB Back Squat	10/8/6/4/2	Per RIR	2:1:1:0	2-3	Weight increase per ladder/RIR, one round
Accessory	Lateral Lunge	4x15	Light/Mod		4	Alternate: Crossover Step Up, Curtsy Lunge, etc
Power	Step-up Triple Flex	6x15 sec	As needed	0:0:0:0		Time per side, 60 sec recovery, quick hands/feet
Jump Skill	Block 3 Day 1	per Protocol				
Run Skill	20M sprints	6 rounds		70%		90-120 sec recovery
Hamstrings	Nordic HS Curl	12/10/8	x	x	x	1 round at each
Quads	Knee Extensions	4x15+	Per RIR	1:0:1:0		Final set to failure, if <12 reps, drop weight
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec				
Pull	BB RDLs	10/8/6/4/2	Per RIR	2:1:1:0	2-3	Weight increase per ladder/RIR, one round
Accessory	Side Plank w/ Hip ABD	4x15			0	Last Set to Failure
Power	Banded Deadlifts	4x6	Moderate	3:0:1:0	3	Fast off the floor, slow eccentric, alternate movement: KB Swings, Banded Hip Thrusters
Jump Skill	Block 3 Day 2	per Protocol				
Hamstrings	HS Curls	4x12+	Per RIR	3:0:1:0	2	Last set to failure, control eccentric/end range
Quads	1L Squats/Leg Press	4x12				Hypertrophy emphasis
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Accessory 1	Nordic HS Curl	12/10/8	x	x	x	
Accessory 2	Copenhagen Side Plank	3x5	x	x	x	Short lever, 12-18in box
Jump Skill	Block 3 Day 3	pe Protocol				
Run Skill	Sled Sprints	8 rounds	50% BW	80%		90 sec rest, 15 M distance
Core	Glute Max Side Plank	5x20 sec	x	x	x	

Goals for Phase 5

- Establish High Intensity Capacity (RIR)
- Skill and Strength Accumulation for Nordic Hamstring Curl and Copenhagen Plank
- Knee Extension Hypertrophy Emphasis
- Optimize Jump Performance and Mechanics
- Introduce Power Variations (Sprinting, Variable Resistance Training, Rate of Force Development Emphasis

Templates (cont'd)

Week 22				Phase 5 (Weeks 21-24)		
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec				
Push	BB Back Squat	5,4,3,2,1/2	Per RIR	2:1:1:0	2-3	Same weight for all sets, two rounds
Accessory	Lateral Lunge	4x15	Light/Mod		4	Alternate: Crossover Step Up, Curtsy Lunge, etc
Power	Step up Triple Flex	5x20 sec	As needed	0:0:0:0		Time per side, 60 sec recovery, quick hands/feet
Jump Skill	Block 3 Day 1	per Protocol				
Run Skill	20M Hill Sprints	6 rounds		70%		90-120 sec recovery, moderate incline
Hamstrings	Nordic HS Curl	12/10/8	x	x	x	1 round at each
Quads	Knee Extensions	4x15+	Per RIR	1:0:1:0		Final set to failure, if <12 reps, drop weight
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec				
Pull	BB Deadlifts	4x8	Per RIR	2:1:1:0	2-3	Weight increase per ladder/RIR, one round
Accessory	Side Plank w/ Hip ABD	4x15			0	Last Set to Failure
Power	Banded Deadlifts	3x8	Moderate	3:0:1:0	3	Fast off the floor, slow eccentric, alternate movement: KB Swings
Jump Skill	Block 3 Day 2	per Protocol				
Hamstrings	HS Curls	4x12+		3:0:1:0	2	Last set to failure, control eccentric
Quads	1L Squats/Leg Press	4x12				Hypertrophy emphasis
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Accessory 1	Nordic HS Curl	12/10/8	x	x	x	
Accessory 2	Copenhagen Side Plank	3x6	x	x	x	Short lever, 12-18in box
Jump Skill	Block 3 Day 3	per Protocol				
Run Skill	Banded Sprints	8 rounds	Moderate	80%		90 sec rest, 15 M distance, posterior banded (partner)
Core	Glute Max Side Plank	5x20 sec	x	x	x	

RTS Block 2 is the primary testing block that allows insight to where an athlete has persisting deficits that may delay projected return to play clearance. Exercise prescription should focus on maximizing testing performance at this time with increased intention on sport-specific skill paid in the remaining phases.

Week 23				Phase 5 (Weeks 21-24)		
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec				
Push	BB Back Squat	8-2 pyramid	Per RIR	2:1:1:0	2-3	8-6-4-2-2-4-6-8, inc. weight as reps decrease and vice versa
Accessory	Lateral Lunge	4x10	Moderate	3:0:1:0	2-3	Note tempo
Power	Step up Triple Flex	6x20sec	As needed	0:0:0:0		Time per side, 60 sec recovery, quick hands/feet
Jump Skill	Block 3 Day 1	per Protocol				
Run Skill	Sled Sprints	8 rounds	60-75% BW	80-90%		90-120 sec recovery, 20M distance
Hamstrings	Nordic HS Curl	12/10/8	x	x	x	1 round at each
Quads	Knee Extensions	4x15+	Per RIR	1:0:1:0		Final set to failure, if <12 reps, drop weight
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec				
Pull	BB RDLs	10/8/6/4/2	Per RIR	2:1:1:0	2-3	Weight increase per ladder/RIR, one round
Accessory	Side Plank w/ Hip ABD	4x15	x	x	0	Last Set to Failure
Power	Banded Deadlifts	4x8	Moderate	3:0:1:0	3	Fast off the floor, slow eccentric, alternate movement: KB Swings
Jump Skill	Block 3 Day 2	per Protocol				
Hamstrings	HS Curls	4x12+	per RIR	3:0:1:0	2	Last set to failure, control eccentric
Quads	1L Squats/Leg Press	4x12	per RIR	x	3	
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Accessory 1	Nordic HS Curl	12/10/8	x	x	x	
Accessory 2	Copenhagen Side Plank	3x8	x	x	x	Short lever, 12-18in box
Jump Skill	Block 3 Day 3	per Protocol				
Run Skill	30M Sprints	8 rounds	x	80%		90-120 sec recovery
Core	Glute Max Side Plank	5x20 sec	x	x	x	

Templates (cont'd)

Week 24		Phase 5 (Weeks 21-24)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec				
Push	BB Back Squat	2x10	Per RIR	2:1:1:0	3	Deload, note RIR
Accessory	Lateral Lunge	4x15	Light/Mod	3:0:1:0	4	
Power	Step up Triple Flex	6x20sec	As needed	0:0:0:0		Time per side, 60 sec recovery, quick hands/feet
Jump Skill	Block 3 Day 1	per Protocol				
Run Skill	Banded Sprints	8 rounds	moderate	80%		90 sec rest, 15 M distance, posterior banded (partner)
Hamstrings	Nordic HS Curl	12/10/8	x	x	x	1 round at each
Quads	Knee Extensions	4x15+	Per RIR	1:0:1:0		Final set to failure, if <12 reps, drop weight
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec				
Pull	BB RDLs	2x10	Per RIR	2:1:1:0	3	Deload, note RIR
Accessory	Side Plank w/ Hip ABD	4x15	x	x	0	Last Set to Failure
Power	Banded Deadlifts	6x6	Moderate	3:0:1:0	3	Fast off the floor, slow eccentric, alternate movement: KB Swings
Jump Skill	Block 3 Day 2	per Protocol				
Hamstrings	HS Curls	4x12+	per RIR	3:0:1:0	2	Last set to failure, control eccentric
Quads	1L Squats/Leg Press	3x10-15	per RIR	x	3	Hypertrophy emphasis
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Accessory 1	Nordic HS Curl	12/10/8	x	x	x	
Accessory 2	Copenhagen Side Plank	3x5	x	x	x	Short lever, 12-18in box
Jump Skill	Block 3 Day 3	per Protocol				
Run Skill	Sled Sprints	10	75%BW	80%		90 sec rest, 15 M distance
Core	Glute Max Side Plank	5x20 sec	x	x	x	

RTS Block 2

Jump Block 3

Day 1 SL landing + increased landing demands		**Day 2: integrating landing mechanics + COD**		**Day 3: Workload Accumulation, Sport Specific Skills**	
Drop to SL hurdle hop: unanticipated, cue for med/lat/fwd	Unanticipated, multidirectional landing + acc	**Drop to angled cut**	Anticipated COD	**Non-contact, sport specific drills/ Practice**	Unanticipated COD, Dual Task Jump Skill
SL Triple Hop	Goal: minimize GCT,	**Rotary skater hops**	Rotational landing skill	**T-test Drill Work**	Accel-Decel-COD
DL DVJ from increased height	(if relevant to athlete's sport)	**Jog to SL decel & stick**	Symmetrical landing mechanics, light to mod intensity		

Goals for Phase 6

- Unanticipated Jump Work should be progressed in a sterile environment with progressive exposure into sport-specific skill accumulation.
- Strength progressions are often under-emphasized when skill work comes in. Athletes should continue to focus on strength and hypertrophy as skill work progresses.

Templates (cont'd)

Week 25		Phase 6 (Weeks 25-29)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded			
Hip Dominant A1	Deadlifts/RDLs/Hip Thrusters	3-4x6-8	per RIR	x	2	
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	Quad hypertrophy
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Knee Dominant A1	BB Back Squats/Cleans/Front Squat	3x10	Per RIR	x	2	
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	Glute/Hamstring emphasis per RTS testing
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Week 26		Phase 6 (Weeks 25-29)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Hip Dominant A1	Deadlifts/RDLs/Hip Thrusters	3-4x6-8	per RIR	x	2	
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	Quad hypertrophy
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Knee Dominant A1	BB Back Squats/Cleans/Front Squat	3x10	Per RIR	x	2	
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	Glute/Hamstring emphasis per RTS testing
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Templates (cont'd)

Week 27	Phase 6 (Weeks 25-29)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Hip Dominant A1	Deadlifts/RDLs/Hip Thrusters	3-4x6-8	per RIR	x	2	
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	Quad hypertrophy
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Knee Dominant A1	BB Back Squats/Cleans/Front Squat	3x10	Per RIR	x	2	
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	Glute/Hamstring emphasis per RTS testing
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Week 28	Phase 6 (Weeks 25-29)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Hip Dominant A1	Deadlifts/RDLs/Hip Thrusters	3-4x6-8	per RIR	x	2	
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	Banded	x	x	
Knee Dominant A1	BB Back Squats/Cleans/Front Squat	3x10	Per RIR	x	2	
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	Banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Templates (cont'd)

Progression Criteria to Begin Non-Contact Workload Accumulation (>24 wks)

- >80 LSI Q:Q Isometric Testing with Handheld Dynamometer
- >.5 H:Q Isometric Testing with Handheld Dynamometer
- >85% LSI Single Leg Squat Test
- >85% LSI Side Plank Hip Abduction Testing
- No More than .5-1mm increase in Laxity Noted from Previous Testing
- IKDC Score greater than 70%
- >80% LSI Single and Triple Hop Test Performance

Month 7-8				Phase 7 (Weeks 29-32)		
Week 29	**Phase 7 (Weeks 29-32)**					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Hip Dominant A1	BB Deadlifts	4x6	per RIR	x	3	RPE 7 or 70% of 1RM if known
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x	x	
Knee Dominant A1	BB Back Squats	3x5	Per RIR	x	1-2	RPE 8-8.5 or 85% of 1RM if known
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Jump Block 4

Day 1 SL landing + increased landing demands		**Day 2: integrating landing mechanics + COD**		**Day 3: Workload Accumulation, Sport**	
Drop to SL hurdle hop: unanticipated,	Unanticipated, multidirectional landing + acc	**Drop to angled cut**	Anticipated COD	**Non-contact, sport specific drills/**	Unanticipated COD, Dual Task Jump Skill
SL Triple Hop	Goal: minimize GCT,	**Rotary skater hops**	Rotational landing	**T-test Drill Work**	Accel-Decel-COD
DL DVJ from	(if relevant to athlete's sport)	**Jog to SL decel & stick**	Symmetrical landing		

Templates (cont'd)

Week 30	Phase 7 (Weeks 29-32)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Hip Dominant A1	BB Deadlifts	3x5	per RIR	x	1-2	RPE 8-8.5 or 85% of 1RM if known
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x	x	
Knee Dominant A1	BB Back Squats	4x6	Per RIR	x	3	RPE 7 or 70% of 1RM if known
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Week 31	Phase 7 (Weeks 29-32)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Hip Dominant A1	BB Deadlifts	3x8	per RIR	x	3	RPE 7 or 70% of 1RM if known
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x	x	
Knee Dominant A1	BB Back Squats	4x4	Per RIR	x	1-2	RPE 8-8.5 or 85% of 1RM if known
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

Templates (cont'd)

Week 32	Phase 7 (Weeks 29-32)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Hip Dominant A1	BB Deadlifts	5x2	per RIR	x	1	RPE 8.5-9.0 or 85%+ of 1RM if known
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Glute/Hamstring emphasis per RTS testing
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Block 4 Day 1					Per protocol, unanticipated work,
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x	x	
Knee Dominant A1	BB Back Squats	3x6	Per RIR	x	2-3	RPE 8.0 or 80% of 1RM if known
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Hamstring or Quad per RTS testing
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					
Core	Front Plank	5x45 sec	x	x	1	Weighted
Jump Skill	Block 4 day 2					
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x	x	
Accessory 1	Nordic HS Curls	12/10/8	x	3:0:1:0	2-3	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS						Specific programming based off RTS testing
RTS						Specific programming based off RTS testing
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x20 reps	x	x	1	Reps per side
Jump Skill	Block 4 Day 3					

RTS Block 4

Progression Criteria for Contact Workload Accumulation Phase (Month 8-9)

- 90% LSI Q:Q Isometric Testing with Handheld Dynamometer
- >.6 H:Q Isometric Testing with Handheld Dynamometer
- >95% LSI Single Leg Squat Test
- >95% LSI Side Plank Hip Abduction Testing
- No Increase in Laxity Noted from Previous Testing
- IKDC Score Greater than 85%
- Nordic HS Curl Break-Angle of >60 deg
- >90% LSI Single and Triple Hop Testing
- T-test Time of GOOD or EXCELLENT

Templates (cont'd)

Month 8-9						Phase 8 (Weeks 33-36)
Week 33	**Phase 8 (Weeks 33-36)**					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Hip Dominant A1	BB Deadlifts	See Note	per RIR	x	1	**1x1@ 9.0, drop 20%, 4x4, Heavy Single!**
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Coach's choice
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	Coach's choice, speed/power emphasis
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Unanticipated Jump Drills					Progressed per individual/sport demands
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x		
Knee Dominant A1	BB Back Squats	See Note	Per RIR	x	1	**1x1@ 9.0, drop 20%, 4x4, Heavy Single!**
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Coach's choice
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	Coach's choice, speed/power emphasis
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	RKC Planks	10x10 sec	x	x	1	On elbows, pull elbows towards toes, max effort
Jump Skill	Block 4 day 2					Progressed per individual/sport demands
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Accessory 1	Nordic HS Curls	12/10/8	x	x	0	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x10	Banded	x	1	Reps per side, banded around knee,
Jump Skill	Block 4 Day 3					

Week 34	**Phase 8 (Weeks 33-36)**					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Hip Dominant A1	BB Deadlifts	2x8	per RIR	x	3	**Deload**
Hip Dominant A2	Hypertrophy Emphasis	2x15	per RIR	x	3	**Deload**
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3x10	per RIR	x	3	**Deload**
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Unanticipated Jump Drills					Progressed per individual/sport demands
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x		
Knee Dominant A1	BB Back Squats	2x10	Per RIR	x	3	**Deload**
Knee Dominant A2	Hypertrophy Emphasis	2x15	Per RIR	x	3	**Deload**
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	3x10	Per RIR	x	3	**Deload**
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	RKC Planks	10x10 sec	x	x	1	On elbows, pull elbows towards toes, max effort
Jump Skill	Block 4 day 2					Progressed per individual/sport demands
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Accessory 1	Nordic HS Curls	12/10/8	x	x	0	
Accessory 2	Copenhagen Planks	3x8-10	x	x	2-3	Long lever, 12-24" height
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x10	Banded	x	1	Reps per side, banded around knee,
Jump Skill	Unanticipated Jump Drills					

Templates (cont'd)



Week 35		Phase 8 (Weeks 33-36)				
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Hip Dominant A1	BB Deadlifts	4x6	per RIR	x	3	70% of heavy single performed in Week 33
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Coach's choice
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	Coach's choice, speed/power emphasis
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Unanticipated Jump Drills					Progressed per individual/sport demands
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x		
Knee Dominant A1	BB Back Squats	5x4	Per RIR	x	2	80% of heavy single performed in Week 33
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Coach's choice
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	Coach's choice, speed/power emphasis
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	RKC Planks	10x10 sec	x	x	1	On elbows, pull elbows towards toes, max effort
Jump Skill	Unanticipated Jump Drills					Progressed per individual/sport demands
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Accessory 1	Nordic HS Curls	12/10/8	x	x	0	
Accessory 2	Copenhagen Planks	3x8-10	x	x	1-2	Long lever, 12-24" height
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x10	Banded	x	1	Reps per side, banded around knee,
Jump Skill	Unanticipated Jump Drills					

Templates (cont'd)

Week 36	Phase 8 (Weeks 33-36)					
Day 1	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Hip Dominant A1	BB Deadlifts	4x4	per RIR	x	2	82.5% of heavy single performed in Week 33
Hip Dominant A2	Hypertrophy Emphasis	4-5x15-20	per RIR	x	2	Coach's choice
SL Knee Dominant B1	1L Squat/Lunge/Step Up	3-4x10-12	per RIR	x	2	Coach's choice, speed/power emphasis
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank Glute Max	5x30 sec	x	x	1	Iso Holds
Jump Skill	Unanticipated Jump Drills					Progressed per individual/sport demands
Day 2	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Monster Walks	3x60 sec	banded	x		
Knee Dominant A1	BB Back Squats	4x6	Per RIR	x	3	70% of heavy single performed in Week 33
Knee Dominant A2	Hypertrophy Emphasis	4-5x15-20	Per RIR	x	2	Coach's choice
SL Hip Dominant B1	1L RDL/Hip Thruster/etc	4x8	Per RIR	x	2	Coach's choice, speed/power emphasis
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	RKC Planks	10x10 sec	x	x	1	On elbows, pull elbows towards toes, max effort
Jump Skill	Unanticipated Jump Drills					Progressed per individual/sport demands
Day 3	**Exercise**	**Reps**	**Weight**	**Tempo**	**RIR**	**Notes**
Movement Prep	Lateral Agilities	3x60 sec	banded	x		
Accessory 1	Nordic HS Curls	12/10/8	x	x	0	
Accessory 2	Copenhagen Planks	3x8-10	x	x	1-2	Long lever, 12-24" height
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS	Per Testing Deficits					Specific programming based off RTS testing
RTS/Sport Specific	Per Testing Deficits					If applicable, otherwise sport skill emphasis
Sport Specific	Case Context Decided					Skill Work based off athlete demands
Core	Side Plank	5x10	Banded	x	1	Reps per side, banded around knee,
Jump Skill	Unanticipated Jump Drills					

RTS Block 5

Deload: 48-72 hours between LE training and scheduled RTS testing is recommended.

9 Month RTS Evaluation: Complete remaining testing, contact chronic workload should be 50-70% of normal in season demands by Week 36 if previous criteria met (i.e. cleared H:Q ratio, Nordic Assessment, Side Plank, Y-balance, Single and Triple Hop Testing, T-Test score of Average or greater, >95% IKDC)

Return to Sport should be treated as a *continuum* rather than an inflection point. >70% Chronic Workload Accumulation of Acute (7 days) in-season workload is strongly recommended prior to full release for Return to Play