In early March 2024 a middle-aged female patient came in with a knee injury in which her ACL (Anterior Cruciate Ligament), MCL (Medial Collateral Ligament), and meniscus were fully torn in a skiing accident. When she came into physical therapy her goals were to get back to her physically active lifestyle including skiing and running. After having surgery to repair the fully torn ACL, MCL, and meniscus, the surrounding muscles had begun to atrophy and weaken due to lack of use. A different patient had chondroplasty in their knee and had no restrictions after surgery. This means that the patient immediately went into muscular endurance, strengthening, and power exercises. With an injury, the surgeons that the patients went to send over a protocol sheet showing how much the patient should be able to do each week after surgery. For different injuries there are different protocols, however, some of the exercises done for the torn ACL, MCL, and meniscus are also done with a chondroplasty. While these exercises are done at different times for these different surgeries, they are the same exercises. They all work to strengthen the surrounding muscles of the knee.

The ACL and the MCL both work to stabilize and support the knee. The ACL connects the femur and tibia and helps support and stabilize the knee by keeping the tibia from sliding forward and the knee from turning too far. The MCL also helps support and stabilize the knee by stopping the femur from sliding side to side. The MCL also keeps the knee from bending too far inward. The meniscus is a piece of cartilage between the femur and the tibia that has many purposes to help the knee. The meniscus acts as a cushion that absorbs shock, helps with weight distribution, and with joint stability and lubrication. The meniscus stops the femur and tibia from grinding against each other every time the knee is bent.

For people who are involved in sports, knee injuries are not uncommon. To repair these injuries is also not uncommon. To repair the ACL, it is usually a reconstruction of the ligament. Surgeons will take tissue from another part of the body, often tissue from the patellar tendon, quadriceps tendon, or the hamstring or they will use donated tissue to reconstruct the ACL. For the MCL tissue can be taken from the patellar tendon or hamstring or from donor grafts that can be from the patient or another person. With meniscus surgery, the surgeon will either remove the piece of cartilage or repair it. For a repair, the surgeon will sew the tear back together. If they remove it, this means trimming and removing the damaged cartilage and leaving the rest of the healthy meniscus intact.

For the ACL, MCL, and meniscus recovery, in the first two weeks of physical therapy the patient's knee is fully extended and cannot bend. The following weeks three and four, the knee can be bent to a maximum of 90 degrees. After weeks three and four, the knee can be bent farther than 90 degrees, however, the patient is still limited to supine exercises to work on strengthening without weight bearing. Since in the first two weeks the knee cannot be bent at all, the exercises that can be done are quad strengthening which includes isometric exercises like the terminal knee extension (TKE) which is focusing on tightening and engaging the quad muscles. With that, they can do more straight leg isometrics. For weeks three and four when the knee can be bent to a maximum of 90 degrees, the patient can continue the TKE's progressing to short arc quads (SAQ) which eventually progresses to straight leg raises. The SAQ is when a patient will have a rolled towel or a roller under their knee and use their quad muscle to lift their shin to make their leg straight. This progresses to a straight leg raise when the quad is strong enough. Being able to do a straight leg raise without the quad lag is very important in making sure a patient can do standing exercises properly and is what is considered successfully doing the exercise. They can also begin working on their flexion and extension actively assisted in weeks

three and four. With that, some of the work done in these first six weeks is by the physical therapist such as patella/tendon mobilization.

Once successfully doing straight leg raises and being able to do the bike with no resistance, it is around week seven. For weeks seven through 12 these exercises focus on muscular endurance. These exercises include lateral band stepping, squat progression, single leg leg press, RDLs, and more. Many of the exercises starting off include a slight bend of the knee with weight. For example, this female patient began with toe taps from a two-inch step. For the squat progression, she held on to a rail and did mini squats which was her squatting however far she could without feeling pain. For weeks 13 through 18 exercises begin to focus on muscular strength. This includes similar workouts to weeks seven through 12 but now includes weights. Some exercises done in this time frame are split squats and deadlifts and hex bar squats. In weeks 19 through 24 the exercises aim to work on muscular power with things such as split jumps and sled drags. Also, during these weeks, the patient should be able to get back to some high-level activities such outdoor biking. For weeks 25 through 28+ exercises work on running, speed, and agility.

The female with the ACL, MCL, and meniscus surgery is currently at about week 23 in weeks 19 through 24 and is progressing normally but on the high end. She can do everything she should be able to and does it well. With her, she will likely finish her physical therapy in a few months from now. To decide if she is done with physical therapy, the physical therapist will run through a VALD test which is an isometric muscle test that will measure the strength of the quad and hamstring. This test is a machine that computes the amount of force a person exerts into pounds and is more objective than the therapists measuring with their hands. With this test it looks for the strength to be within 95% of what the non-surgical/non-injured leg is. Every person heals and recovers from major surgeries differently. While some may take longer to do certain exercises, some can do them earlier than expected. The patient with the chondroplasty surgery will typically finish their physical therapy in six months while the ACL, MCL, and meniscus physical therapy is around a year long.

With that, both patients intend to return to sports which are high intensity and will require them to be at maximum strength. Both patients will have to complete the run readiness testing. This includes doing step ups, single leg squats, and wall sits with the swiss ball. Successfully doing these exercises according to the return to play protocol means they can do the step ups and single leg squats to 160 BPM on the metronome. With many sports it requires a lot of work in the knees. For the patient who had a chondroplasty, they intend to run track in college. The patient with the ACL, MCL, and meniscus surgery wants to be able to ski, run, and do cross fit. While they are not aiming to get back to the exact same activities, they will have to successfully complete the same test. Many exercises are given throughout the entire time someone is in physical therapy, but they are also doing work while they are at home.

Although a person does not have to compete in a sport to tear something in their knee, it is a known injury to many athletes. Knee injuries can happen from many different things. Throughout the recovery process, much of the work done focuses on quad and hamstring strength. While not every knee injury will have the exact same exercises, it is likely that many of the exercises a person will do will look to strengthen their quads and hamstring muscles. With the work a patient does while in physical therapy on top of doing the exercises given to them to do at home, they are able to regain a majority if not all of their strength and get back to their

normal daily activities. Physical therapy helps many people for many different reasons. Not every person in physical therapy had surgery. Within the next few months both patients should expect to be able to get back to their normal physical activity levels and not be inhibited by thier injuries.

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