Fundamental movement skills - Part 1

Welcome to module 6, Applications of Human Movement Science. So in this module, we will be looking at how the human movement principles we have studied in the previous modules can be applied to fundamental movement skills. So what those are exercises, so some common exercises that we will be going through and gait. So the learning outcomes specifically for this module is to understand what fundamental movements are, why are they key as building blocks to understanding sports skills, the implications of acquiring them, right? And also how can we analyse them? So some movement science principles that we will be applying to analyse these fundamental movement skills. Now let us understand that we have looked at the integration of functional anatomy, biomechanics, some tools and techniques that we can use to study the biomechanics or the kinematics and the kinetics. And we have also looked at motor control, phasing and different events or key events of interest, right? All of this information put together now, we will be starting to apply these to understand the different skills, right from fundamental movement skills to sport.

So what are fundamental movements? So as the name suggests, fundamental movements are your foundational skills. So imagine when you are trying to construct a sentence or write a paragraph, we always start with syllables or words, right? So we have looked previously at how motor skills or gross and fine motor skills are quite important. So when those put together, they form fundamental movements that are your building blocks or your ABCs for sport. So as we can see the definition here, fundamental movements are your foundation movement skills that form building blocks for more complex and specialised everyday tasks like physical activities and sport.

So these are categorised into or can be broadly categorised into three locomotor, and we will be looking at these in detail in the next few slides. You also have stability skills and you have manipulative skills, right? So these names as you can see are self-explanatory as the word goes in English. So let's look at what are locomotor skills. So as the name suggests, locomotor skills help you change body position or move through space.

So any skill that is dominant, which requires a change in body position or for you to move through space are categorised under locomotor skills. So what could these be? So example could be walking, running, jumping, leaping, right? All of these have a change in position as we've looked at in the kinematics module or you're moving through space, right? So there's walking, running and jumping as your examples of locomotor skills. Now we will be diving into these specifically, how to analyse movements here, how do we understand the different phases in here, the different muscles in the next few slides. So let's look at stability skills. So while locomotor skills allow you to move or change body position or move through space, stability skills allows body to remain stationary.

So there are skills where body is stationary and there's a control of position and balance, right? Without the change of location in space. So it's more got to do with how do you position or you control the position of the body, maintain balance, right? Or regulate control. So what are some of the examples of these? So for example, skills that need at most balance, right? Or twisting and turning. All of these three skills if you see, the underlying biomechanical characteristic. So the underlying biomechanical characteristic here is the control of body position and balance.

So let's look at manipulative skills. So as opposed to locomotor and stability, manipulative skills are when you combine these two. So you combine the locomotor and the non-locomotor movement and execute control, coordination and the skill requires handling and interacting with various objects, right? So there is control, there is coordination, you are moving, it's a combination of moving and non-moving which is locomotor and non-locomotor and you're manipulating or you're handling various objects. So these are our manipulative skills. So what are some of the examples of manipulative skills? So you can look at throwing, so you're catching a ball or you're throwing a ball or you're kicking a ball, you have interaction with the ball.

So different body segments have the interaction and there is a lot of balance, control and coordination that's required to execute them, right? So now that we've looked at these three skills and what the definitions are and some of the examples, right? Let's dive a little bit deep into them. Implications of acquiring fundamental movements. So why would it be important, right? Why are these fundamental movements important? So we do know that they are the building blocks. So for holistic development, so holistic as in overall or generic. So for holistic or generic development, laying a good foundation is primary, right? So for example, even when you're building a building, right, a good foundation or a good structure is quite important, right? So let's have a quick look at this diagram.

So what does it say? It's for the development. So holistic development here encompasses your physical components, cognitive abilities, right? Your sporting skills, your motor skills, as we've looked at earlier, and also social development, right? So how do fundamental skills or fundamental movements help you develop in these areas? We look at the next few slides. So for now, let's understand that it's crucial for overall well-being, right? So all of these developments put together, it also enhances your well-being or your ability to participate in any kind of physical activity, right? And also your cognitive and social abilities. So like we looked at, strong foundation is quite required in all of these developmental areas for individuals to build more specialized skills or more complex skills, right? So they can participate in various sport and recreational activities. Right, so let's look at them one by one.

So how can they contribute to physical development? So these fundamental movements help you in developing strength, flexibility, coordination, and your overarching physical capacities, right? So you're building these one by one. So hence, it's quite important for physical development. How does it aid in cognitive development? So cognitive development, it helps you to learn and master these movement skills that then builds different patterns for you, right? So your brain is trained in spatial awareness. So for example, if you're trained in catching and throwing, it develops your kinesthetic awareness, which basically is where is the ball? Can you locate the ball? How far do you need to move in order to catch the ball? How do you need to position, right? So all of these are your spatial awareness or kinesthetic awareness, which we'll see in the next few slides. Also at recognizing patterns, right? So how is a player positioned? How do I move looking at the player in front of me, if it is a strategic or a tactical output? And also in that scenario help you to do decision making as well.

So understanding these fundamental movements helps you in cognitive development in such scenario. What about social development? So of course, when you participate in various physical activities or sport, it promotes social development because it helps you build on teamwork, communication and social interaction, right? What about motor skill development? So in order to develop more motor skills, these are the essential building blocks, right? For more advanced or sports specific motor skills or movement patterns. In sport, mastering these skills prepares the individual for any kind of complex activity or demands, right? Such as versatility. So for example, if you have all of these building blocks as a good foundation or good technical knowledge around that, you have versatility of skills. So your transferability of these skills into various sport becomes extremely easy, right? So you have, if a child has all of these fundamental movements perfected or has gone through training for these fundamental movements, to adapt any kind of sport becomes extremely easy, right? So it's beneficial for early to long term athlete development.

So this is where you would start them as young athletes and then progress more towards the complex movements or the sporting activities. So why applying these skills hence looking at all of these development is important. So while applying it, just remember it's a multi-dimensional approach, right? You need to still think about, and of course this is a brief overview of what fundamental movements are, how we can apply them, but for deeper philosophies into the coaching science and how do we apply these for each individual athlete, you'll have to read more, right? But it's a multi-dimensional approach and this approach informs the intricacies of how our body is adapting to the environment, right? How our body is adapting to the physical world. It also gives you a knowledge into, for example, talent identification, right? Now, how would it allow us to identify talent? If a child, for example, is able to perform these, right? And able to improve on these and we can track up their progress or their intensity of progress on time, then it

gives us an understanding into what's the learning happening, how are they reacting, what's the stimulus, right? And what's the rate of development. They also pose as we looked at building blocks of physical activity, understanding the underlying science, right? So it helps us to understand the underlying science and our ability to perform them with precision and purpose.

So again, when you're doing talent identification, if you could segregate the kids who are performing this with precision and purpose, you can gain an understanding into if it's their natural ability or if you need to improve or work on them to nurture the underlying talent, right? So hence, understanding the functional anatomy, the biomechanics, the motor control, all of these interactions of these fundamental movements to be able to coach them properly, right? And to build a solid foundation as we've looked at, it helps us, right? To have a good technical foundation, which is extremely important, right? So let's look at some of the skills characterized under the categories and let's delve into them a bit deeper. So let's look at the vertical jump. So when we are trying to analyze the vertical jump, we need to start with what's the aim. So the aim here is of course to achieve maximum vertical jump or maximum vertical distance, right? So that's our aim to achieve maximum vertical distance. So depending on the characteristics, because you have various vertical jumps, so depending on its biomechanical characteristics, you will be testing different performance outcomes, right? So vertical jump is one such fundamental movement that is used for performance testing and those performance testing parameters depend on the underlying biomechanical characteristics.

Let's look at them. So for example, we have the squat jump, right? And you have a counter movement jump. So as these two jumps suggest, and we'll be looking at these in detail shortly, they're quite different. They both achieve maximum vertical distance, but the biomechanical characteristics of how they are performed and the underlying technique is different. Let's look into them. So the performance outcome of both these tests would be to test your lower body strength and explosive power, right? So when you perform these tests based on how you score them, how the kids score them, you can have a fair assessment of lower body strength and explosive Power.

So let's look at some of the comparisons between the two tests. Now I know this table is a little daunting, but let's get into it one by one. So let's start with movement pattern, right? So how does this movement pattern differ between the two of them? So with the squat jump, it is less complex because you have your hands on your hip. So when you're performing a squat jump, you have your hands on the hip, you start from a squat position, right? And then you execute first descent and then go on to ascent. Whereas with a counter movement jump, you have got your hands free, so you can use your hands to find that arm swing that helps you propel, right, in the vertical direction.

So hence, it's a very dynamic action, right? Because you're using your arms in order to help you propel vertically. And hence it makes it a very complex movement pattern as opposed to the squat jump. Now, as we spoke about the hand technique, right, so the hand here in the squat jump, right, is quite important for stability and support because you're on your hips, so it provides good stability and support. Whereas in a counter movement jump, as the name suggests, the arm swing allows for a counterbalance or a counter movement, right? So the dynamic swing then helps you to transfer all of your force that is produced from your lower body into the jump, right? So looking at the force production, it's primarily through concentric muscle contraction. So if you're revising back to our functional anatomy module, you should be aware of what the term concentric means, right? So it is concentrically contracting, so that's how it's producing the force.

However, for a counter movement jump, because you're using your arm swings to counterbalance, it's a combination of concentric and eccentric muscle contraction, right? So it's a combination. The fourth one would be the training goal. So if you're using this fundamental movement for training, right, before you test them, squat jump is an excellent test to look at primarily lower body strength, right? So it primarily allows you for lower body strength testing. Whereas counter movement jump because of your arm swing again is an excellent test to look at explosive power, right? So what you can counterbalance and you can execute. So it's more to do with your explosive power.

Now let's have a look. Of course, we have low body strength that is measured by CMJ as well, but specifically or dominantly it is looking at explosive power. So let's look into the movement analysis of these two jumps, right? So what's the functional anatomy behind it? So the plane of motion, so where the jump is happening is sagittal, right? So you, for a squat jump, let's just have it here. So squat and that's CMJ. So for a squat jump, you are in a squat position, right? And then you have got your hands on the hip.

So bear with my drawing. And you're executing from this position, right? So what's the plane? The plane is sagittal. And what's the view? The view is lateral view. So going back to when you're analyzing this, you can do this using a video camera. You can also do it using force plates. So the way you would analyze this is, let's just put this here.

So there's video camera. There's force plate. And we look into what are some of the important variables in the next few slides, right? So this is a lateral view, right? And you've got the video camera and force plates as the sources that you can use to analyze these. Whereas for a counter movement jump, right? Let me just see if I can probably have these there. So just imagine that you're starting the arm swing and then this arm, right? So the arm swings forward, right? So that's the major difference between the two. So both of them are in the sagittal plane.

Both of them are, we're looking at the lateral view, right? So what are some of your major muscles, right? Let's look at them. And what is its role? So of course there's knee extension happening here, correct? So once the body is pretty much upright, so you go from that position into that and the same with that position into that, right? So the main actions happening here are knee extension. And as we all know, knee extension is majorly by the quadriceps, right? And revising again our functional anatomy. Quadriceps are made of rectus femoris, vastus lateralis, vastus medialis and your intermedius, right? So just quickly recapping that for you. So there's knee extension happening from here to here during the jump.

Also what else is happening? So your hip is extending as well, right? So your hip is extending. So for hip extension we have primarily the hamstrings, which again let's revise our bicep femoris, semitendinosus and semimembranosus. So these are our hamstring muscles, right? So they are key or primary for hip extension. So apart from hip extension and knee extension, what else is happening? This is what we have forgotten, right? So if we look at our ankles, which we have forgotten, the reason I'm drawing this is because you would land on your heel and you would absorb it in. So what's happening here? Oops, you've got gluteus maximus as well, right? So we are having ankle plantar flexion, right? So you have dorsiflexion and plantar flexion.

So we have ankle plantar flexion going on and the muscles that are responsible for ankle plantar flexion are your gastrocnemius and your soleus. So three major actions happening here at the hip, knee and your ankle joint, right? Right, so let's look at what are the phases, right? So what phases are we looking at? So again, let me just quickly draw that. Right, so from here, both the phases are same, right? So imagine if you have your hands either there or there for any of the two jumps, right? So what are our phases? So the starting position for a squat jump, if you can see is static. So it starts from a squat position, which we've looked at. And for your counter movement jump, you are starting from a standing position, right? So actually, let's just do that on the right.

So from here, you then get into the arms swing, and then you get into the, sorry, from there you get into the jump, right? So the starting position for the counter movement jump is standing position, right? And then you go into the descent and then you go into the ascent. So let's look at the descent phase. So descent phase is nothing but the downward movement, right? So that's your downward movement. So it's a controlled downward movement. So important to know that it's a controlled action, and it's a controlled downward movement.

And the emphasis or the stress on the functional anatomy here is that it's a dominantly eccentric phase. So we've looked at what eccentric phase is, what eccentric contraction is, right? So it's a controlled downward movement, and focuses on the eccentric phase, right? Whereas for a counter movement jump, it's a quick downward movement. Now

why that's happening is because of your arms swing. So you quickly get into a downward movement and you propel up, right? So it's quick versus control.

So control versus quick. So an important differentiation for your squat versus CMJ, right? And your knee and hip flexion, right? So that's the movement that's occurring, which is your knee and hip flexion as the body descends. So as you descend into a squat, you're going into a knee and hip flexion, right? So what are the major muscles there? So you have your quadriceps, hamstrings and glute maximus that help you to activate or to control the descent. That's what they help you to do, is to control the descent. And the arm swing in the counter movement jump, it's quite effective to utilise the stretch shortening cycle. So your arm swing in the counter movement jump, right? It helps you to activate or for effective utilisation of the stretch shortening cycle, which pretty much is the storing of the elastic energy and then you exerting that, right? So your arm swing helps you achieve that.

Now the next one, once you get from the descent phase is the ascent phase, right? So ascent phase is nothing but the upward movement, right? So you've looked at the downward movement, which is a descent phase and then you get into the upward movement. So this is exactly whether you initiate the jump and you start the jump, right? So the jump is initiated from the bottom of the squat, where it comes to the squat jump. And here what is happening is you are looking at mostly concentric muscle contraction to be able to execute that jump, right? So it is stressed by concentric muscle action. Whereas in the counter movement jump, the jump is initiated immediately, right? So you get into the arm swing, you move down and immediately the jump is initiated. So again, very important to note that it is initiated immediately and after the counter movement and the stress here is on the stretch shortening cycle, right? So the stress here is on the stretch shortening cycle.

So using that to propel forward, I mean upward. So there’s a rapid extension that is happening at the hip and the knee joints. So let's remember in the descent phase, the hip and the knee go into flexion, whereas when you're ascending, they go into rapid extension. We've also looked at what the muscles responsible earlier, quadriceps and the hamstrings and for force production, there is concentric contraction, right? So this, as we spoke about, quadriceps, hamstring and your gluteus maximus, right? So these are your major or your big muscles of the lower body that help you get into these different positions and help you generate or produce force, right? So the arm swing here helps you to rapidly coordinate the movement, right? So imagine if you did not have this counterbalance and you're executing an explosive jump, the movement wouldn't be as coordinated, right? So the use of the arms here is to also coordinate the movement so that there is explosiveness in the jump, right? To coordinate that.