Qualitative analysis - analysis and injury

Hello everyone, welcome to module 5 of Human Movement Science. In this section, we will discuss about the qualitative analysis, particularly about the qualitative how the qualitative analysis is being performed and how it can help in injury prevention and rehabilitation. So, in this module, we will start with the general introduction to the qualitative analysis which has been covered in the previous section. Then we will look at the methodology being utilized for qualitative analysis and then we will have few examples or where we look how qualitative analysis can be utilized in injury prevention and rehabilitation. So let us say qualitative analysis. So qualitative analysis is descriptive in nature which involves various senses of the human body such as feeling, vision, you smell something or you taste something, you hear about something, in general it is subjective in nature.

So qualitative analysis is nothing but systematic observation and introspective judgment of the quality of human movement. It involves the temporal faces, so temporal means related to time and spatial aspects which is related to the space. The critical features which predominantly contribute the successful performance of the scales come under the qualitative analysis. So in qualitative analysis, we look at the critical features of a movement which predominantly contribute for a successful performance of a particular scale.

For example, jump landing, so what are the critical features, how the different segments are moving with respect to each other and then help in the successful completion of the task at hand. So the qualitative analysis also focus on identifying the various errors. For example, how the different limbs or the different segments of the body move relative to each other to perform a specific skill and whether there are certain errors which are present in them and how to correct those errors using training and coaching. So next step, we will look at the various steps or stages which are involved in a qualitative analysis. So the first stage is the preparation stage in which we have to prepare for the whole environmental settings to perform a qualitative analysis.

This is being followed by an observation stage where the data collected in the preparation stage, we will observe and record the data. Then the next stage would be the evaluation stage. So in evaluation stage whatever data or whatever the parameters or aspects of a movement we collected during the observation stage are evaluated to provide a feedback. So at this stage during evaluation stage if we think like we are missing certain things we can again go back to the observation stage and then include those parameters. And finally, the intervention stage.

In intervention stage also sometimes we feel like during this intervention we might be missing certain aspects so we can jump back to the observation stage and then move to

evaluation stage and then intervention stage. So once we know the interventions which are required to be performed or which have to be incorporated to improve the performance then we again go to the preparation stage after a training or successful implementation of the suggestions from a qualitative analysis. Now let us look at the subcomponents of these stages to understand it more holistically. So let us start with the preparation stage. The first step in the preparation stage is to ascertain the need analysis like what is required of this analysis.

For example, whether this is a study for injury prevention or rehabilitation or performance enhancement. The next step would be gathering the knowledge of activity and performance. For example, whether the activity is performed in an indoor environment or an outdoor environment or whether this is an activity on a single player or it is a team activity. Another thing which we need to take care of during preparation stage is to look at the critical features of the movements. For example, the range of motion or spatio-temporal parameters related to a movement although these depends upon the skill level of the athlete.

The next thing which we need during the preparation stage is the knowledge of the characteristics of the movement under observation and also at the characteristics of the performer. For example, the movement under consideration whether it is for distance or time. For example, for distance would be a long jump where the time to complete the long jump is not the main requirement whereas in sprinting you have to complete the race within the minimum time, but in long jump you have to cover the maximum distance. So, those are the characteristics and then the characteristics of the performer also depending upon their skill level. So, in general preparation stage is nothing but knowing what to do and how to observe that.

Next is the observation stage. In this stage the steps involved developing a systematic observation strategy. For example, who will observe and what he or she will observe. The next thing would be the collection of the information about the movement from the human senses or video recording. In this the examples would include whether the information is being recorded using paper waste evaluation sheets or notational sheets or more objective analysis such as performance rating scales which can rate the performance from 0 to 10 or any numerical value.

Then we have to define the focus of observation. For example, whether we are looking at a specific phase of a movement or movement as a whole. The next thing in the observation stage will be related to the vantage points. The vantage points is from where to observe like whether you need the information in multiple planes or in just one plane. For example, when somebody is doing a horizontal jump whether you want to look at the frontal plane or the sagittal plane or the side plane and number of observations.

So, these are required for the reliability of the study. So, in totality what we can say in observation stage what we are focusing on is how we can observe the movement reliably. So, the next stage is evaluation and diagnostic stage. In this stage we will look at the strengths and weaknesses of the performance. For example, what are the symptoms which we observe during that movement under consideration?

For example, joint range of motion for upper or lower limbs whether they are inadequate, whether they are within good range or whether they are you know at par with the requirements. Another thing which we look at this stage is use of various movement patterns in addition to the video recordings. This will help us to understand the mechanics of movement. Next thing we will look at the validity and reliability of the data. This is basically dependent upon the analyst more so on the practice training or knowledge of the analyst.

Next thing which we look during this stage is on the variability of movement errors and analyst bias. So, in this the errors or variability may be due to the annotation in the videos or recording errors or you know it is a human tendency to do certain things in a specific way. So, that might result in a bias. So, it is dependent upon the analyst also. In the next phase of evaluation and diagnostic stage what we will look at is the interventional approaches.

So, these are dependent upon the features of the movement. For example, whether you need skill specific training or general strength and conditioning. So, to sum up in evaluation and diagnostic stage what we are looking is what is right and what is wrong in a particular movement. And finally, in interventional stage we will focus on the feedback to the performers. So, this feedback might be very specific to a technique or for a performance in a general.

Next thing in interventional stage which is important to note is how, when and where to provide the feedback. For example, whether you will provide visual feedback or verbal feedback, whether that feedback is provided during the performance or after the performance. This also discuss about the issues being faced during the practice. So, this will provide interventions based upon individualized sessions for athletes which are based upon motor control models. Similarly, in this stage we will also look at the issues about the technique or skills or training.

So, in this we will focus on whether we need a specific training or a coaching session to improve upon the deficiencies observed during the analysis. So, the number of observation also play an important role in intervention stage because they will tell us the variability in the movement. So, in intervention stage we will provide we will dealing more on the feedback and how to appropriately provide that feedback to the performer. So, let us

discuss these concepts in this particular example. So, here you can see an athlete is performing single leg hopping.

 So, from observational point of view so, here you can see the athlete starts from here we can see the athlete we have focused on the sagittal as well as this view is like side view or sagittal view and this one is the frontal view. So, here we can clearly see in frontal view we have the recording from starting to end whereas, in the side view or the sagittal view we do not have the recording for the landing phase or the end of the activity. So, here we can see we have to loop in all the four stages of the qualitative analysis. For example, during observation phase so, we had to plan accordingly. If the last landing in the third hopping is important then we need to refocus and it is dependent upon the space requirements like where the activity is being performed, the background. Similarly, in the preparation phase we will have a focus where we will look at the movement from different perspective and whether your video recording is set appropriately like there should be no tilt whether we are looking at the video like straight on or from an angle.

 In observation phase or in evaluation phase we will look at how the athlete is performing for example, if we look at the final standing, final landing over here if I mark two on the hip joint so, there is a tilt in the so, there is a like slight bending towards one side towards the supporting leg. So, this will be the evaluation and finally, in the interpretation so, the feedback will be provided to the athlete. So, what are the different principles which are involved when we look at a movement from qualitative perspective? So, there are various principles we will discuss them in this section. So, first it comes with the universal principles. So, universal principles include the stretch-shortening cycle of the muscle contraction, minimization of energy, and control of degree of freedom in the segmental change, how different segments are controlled during the movement.

 Next principles involved like partially general principles. So, in this we will look at the sequential action of muscles while looking at the movement at different segments or joints, minimization of energy or increasing acceleration of the movement depending upon the requirement of the performance, impulse generation or absorption this also is dependent upon the movement under consideration or maximizing the acceleration path. This also depend upon the output requirements of the movement and finally, the stability path. In addition to that there are specific principles which are very specific to the movement under consideration for example, sport specific task. So, the movement considerations for a long jump are different from the movement considerations for or analysis considerations from a sprinting activity.

 For example, in long jump we are more focused on the distance jumped which depends on takeoff distance, flight distance and landing distance. And there are other principles which are less useful for example, summation of joint torques, continuity of joint torques, equilibrium or stability which is difficult to observe when the movement is very fast, and

the compactness of the movement. So, these features are difficult to observe in a qualitative analysis that is why they are being used with more experienced analyst, but they are you know useful, but least useful compared to the other movement principles. Now, let us take an example how qualitative analysis can be utilized in an injury. In this example we will observe the tuck jumps.

So, tuck jumps are jumps where you have to bring your knees in front of your body rather than kicking your thigh with your heels. So, let us have a look on this movement. So, here you can see this movement is performed repeatedly and this movement is important in performance enhancement like it comes under the plyometric training as well as in research it has been shown that the evaluations qualitative evaluations from tuck jumps are useful in the injury prevention and rehabilitation process for ACL injuries. So, let us see what are the requirements or what are the critical factors which we will look during this movement in an athlete or in a general population. So, in tuck jump assessment we will look at the knee joint valgus at landing when the athlete or the participant lands, what is the position of their knees with respect to their normal posture.

Whether the thighs are parallel at the end of the peak jump, whether the thighs are equal side to side during the flight, whether the foot placement is shoulder width apart, whether the foot placement is parallel like not in front or back, and the foot contact timing. We will look at all these factors one by one in the upcoming slides. For example, knee valgus landing at the at the landing. So, over here in this snapshot of the video you can clearly see if I try to join the joints. So, you can clearly see there is a slight valgus at the knee joints in this particular participant.

The next would be we have to look for position of thighs at the peak of the jump. So, when the athlete is at the maximum height of its jump then we had to look. So, this is being observed from the sagittal plane. So, over here so, if this is our horizontal dotted line is our horizontal line then we can see athlete is not able to place their thighs parallel at the peak of the jump. Another thing which we look in qualitative analysis in this movement is whether the side to whether left and right sides are equal particularly the thigh segment are equal during the flight.

So, over here we can clearly see if I draw a axis from here for the left thigh. So, this is left, this is right and then the right thigh. So, you can clearly see there is a deviation or there is a slight difference. Another thing which we can look at like from the side plane or you know sagittal plane is the location of the feet. So, here you can see they are not at equal distance from the ground when the athlete is during the flight.

Another thing we will look at is the foot placement. So, if these are the shoulders approximate location of shoulder. So, we will draw a vertical line and then see whether the feet are placed. In over here you can see like sorry for the wrong line like the left side

is bit medially moved the left foot is more towards the center. Another way of looking at it is like you can look at this line and then the distance between these centers.

So, this distance is more compared to this one and then if I draw a central line from shoulders. So, you can see at the left foot the participant or the volunteer has moved more medially compared to the right side. Similarly, we will look at the foot placement again whether they are parallel or not. So, over here you can see in the sagittal plane the axis for your left foot is over here and the right foot was over here. So, they are not aligned properly or not parallel when the athlete lands.

And foot contact timing in this picture you can clearly see the left foot is already in contact and the right foot is still in the air over here. So, these things will help us to perform a qualitative analysis for injury prevention or performance enhancement. Apart from these things there are certain other factors which are considered for this particular movement which include excessive landing contact noise like whether the there is athlete is putting more pressure on the ground while landing which you can hear while observing the movement. Is there pause between the jumps like is it consistent like it since it is a plyometric in nature so you have to jump as soon as you land. But whether the athlete is taking pause between the jumps, whether the technique is declining prior to the duration of the test.

So, we looked at parameters previous 6 parameters. So, whether all those 6 are declining after a certain for the standard for this test is like they have to perform it maximum number of touch jumps in 10 seconds and whether that movement, critical movement features are being maintained during those 10 seconds or they are declining prior to the whole duration of the test. And finally, we will look at whether the athlete is landing at the same footprint or not. So, with this example we can see how a qualitative analysis can be performed and then help us in identifying the critical features of a movement which will help us to provide inputs on performance enhancement which in result also help us to understand the mechanics behind that movement and finally, help in injury prevention. And once an athlete get injured during post rehabilitation we can perform these tests to see whether the athlete is ready to go to sport for example, in rehabilitation process.

So, with this I would like to thank you for your time and attention.