Mechanics of Human Movement
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Lecture - 07 Part b
Muscle Action - Part II

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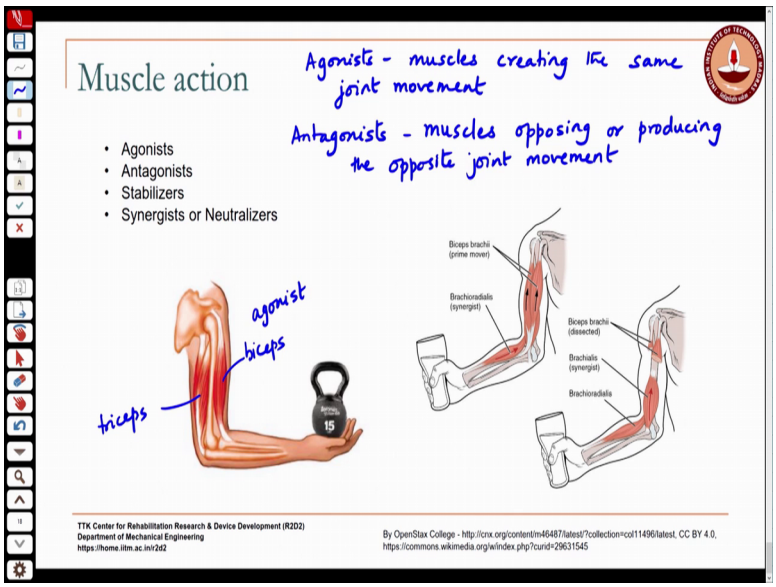

Let us take this example of this elbow flexion example where I am carrying a load and lifting this load. So, I am lifting this load so, the biceps let us say this is the biceps muscle has to actively contract for me to overcome there is a string moment and concentric action concentric action.

So, in this case the biceps for this particular action is called the agonist muscle yes the intent tracks to perform the intended action is called the agonist muscle and there may be more than one muscle doing that so, they would all be a agonist for that particular movement. So, it is possible that in this case depending on the load that is being lifted the biceps you may also have two more muscles the brachialis. And the brachioradialis which are also muscles that are elbow flexors they may also be recruited to perform that in which case those are also agonists.

Now, the antagonist: so, agonists are the muscles creating the same joint movement, the antagonists these are the muscles that are opposing.

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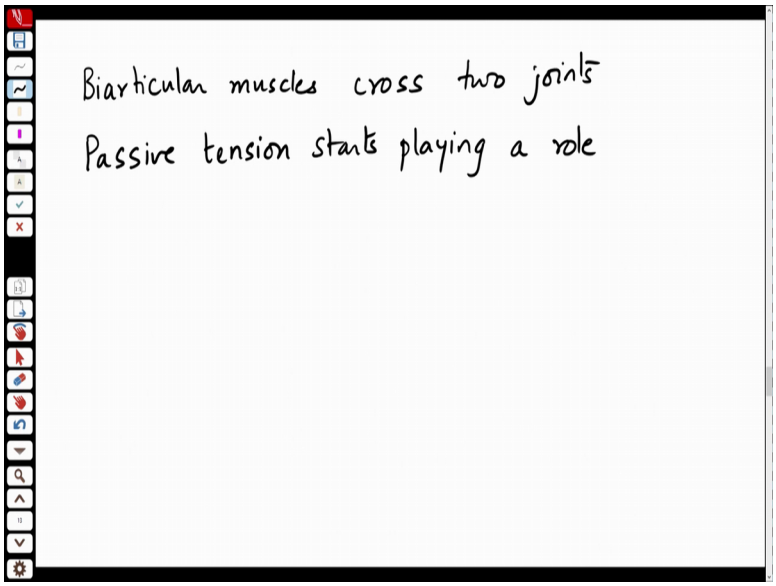

Or producing the opposite, the muscles that are the elbow flexors are my agonists. And the muscles that are responsible for extension of the elbow are the antagonists for this particular action.

Student: (Refer Time: 02:47) they are not (Refer Time: 02:49).

Sorry.

Student (Refer Time: 02:52) they (Refer Time: 02:55).

They may or may not be they may or may not be.

Student: (Refer Time: 03:01).

No not necessarily because you can even when it is lengthened you can if you go back to the length tension curve.

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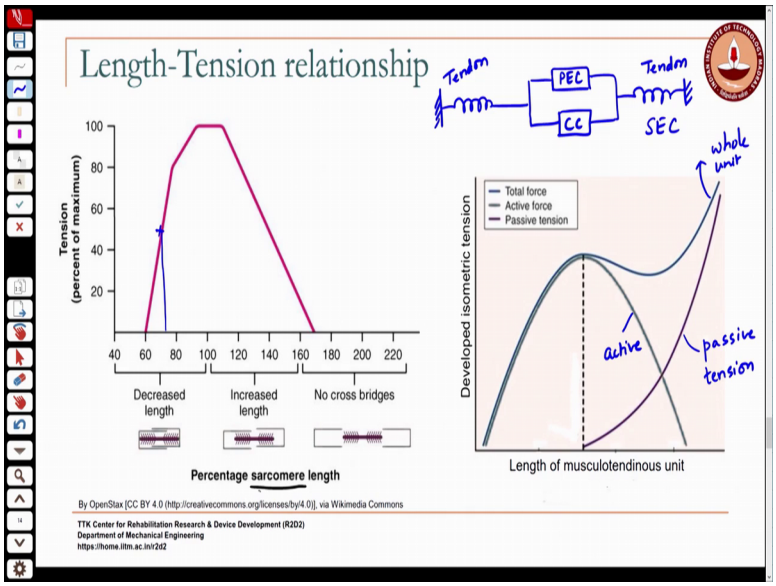

Even when it is lengthening you could have active to even in the lengthened form, let me give you an example if you are walking downhill. So, your knees you know when you are walking downhill gravity is making you come down fast now you have to control your knee, your knee may be bad, knee extensors maybe in length may be elongated maybe lengthened, but they will still be contracting to prevent you from falling. So, that is an example where in the lengthened condition you still have active muscle action happening.

So, there that is your agonist muscle even though it is in the lengthened form. Similarly here another example with the same elbow, if I am carrying a heavy load and I start lowering it do what controls the speed, it still my flexes, but they are lengthening and I am still you will be able to see the bulge right if you have a carrying a heavy you know that the muscle is also acting it is also contracting to control this movement ok.

So, in this case the biceps are again the agonist muscle even though it is being lengthened, because the load that is actually causing this working against, this is gravity it is not necessarily the if I use my triceps to extend my elbow then the triceps are the agonist and the biceps would be the antagonist, but if I am lips are actually at still the agonist muscle for this particular task. So, it is very task based it is not that some muscles are always agonist, some muscles are always antagonists like I said: if I actively extend

the knee the quadriceps muscle acts to actively extend the neutral. Then again my quadriceps muscle is my agonist and the hamstrings which are resisting that or it are the.

If I am flexing my leg like this then at my hamstrings to flex my knee I have to contact my hamstrings to flex my knee. So, they are the hamstrings are the agonists because I am voluntarily flexed. So, the hamstrings are the agonist in that case the quadriceps are my antagonists so, the same set of muscles and function as agonists or antagonists it really depends on the task.

Flex my try I mean, I could contract my triceps also right when I do that provide additional resistance I could do that, because these are all voluntary muscle are the skeletal muscle can be controlled voluntarily. So, I could contract it when you are in therapy or for exercise they will teach you to kind of isolate your actions. So, that you work hardest on the muscle that you want to build strength them. So, they will say no relax, relax your other muscle. Because, typically when you are tense what happens you try to contract everything that is possible. So, they will say no, relax this one do only this do only, you know if you are doing an elbow flexion exercise say relax your triceps.

Depends on what you depends on the objective of the exercise if you are trying to strengthen your elbow flexors for instance, you want to focus all your when we do the static analysis later you will see that if I am also extending sorry; if I am also using my triceps then I would actually be loading my joints more which may not be desirable. So, I want to only load it to the extent that is necessary. So, if I am using both muscles on both sides to tighten and exert tension then I would be loading the joint more. So, it may be more favourable to only use one muscle action to perform a particular task.

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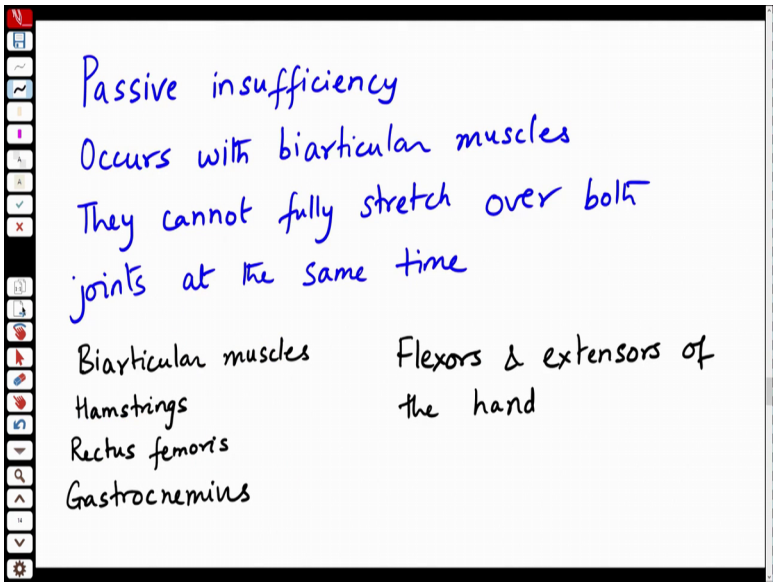

So, then you also have muscles that are called and this is usually in your stabilizing effect on the in that complex to allow your arm or leg to do what you wanted to do. So, these are muscles that really do not move very much, the muscles in the chest and the shoulder or not the shoulder, but in the back and the chest which kind of hold things in place. So that is why they call these stabilizer muscles.

Similarly you have in the pelvis you know as you are walking to maintain this step because everything is it is all you know a bunch of interconnected links. So, to hold the pelvis stable while you make movements with your leg like for instance when you are walking you will have muscles that act only to do that they are called stabilizer muscles. So, in a muscle and they typically undergo very little movement.

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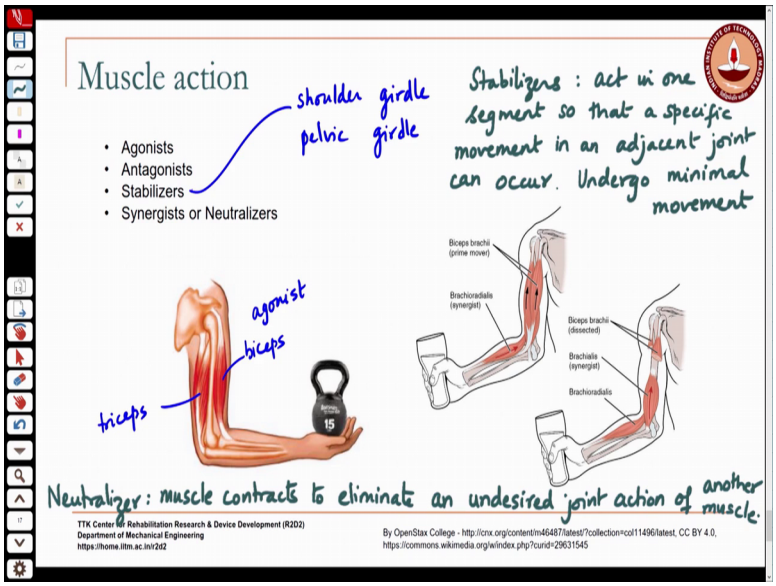

So, stabilizers specific movement in an adjacent joint it is like keeping one thing fixed so, that you can move the other the way you wanted. So, these are muscles that go undergo minimal movement.

Then the fourth kind are what are known as the synergies or the neutralizers, and the function of these as the name suggests you know cinema neutralizer is to eliminate an undesired joint action. So, is a muscle that contracts to eliminate an undesired joint action of another.

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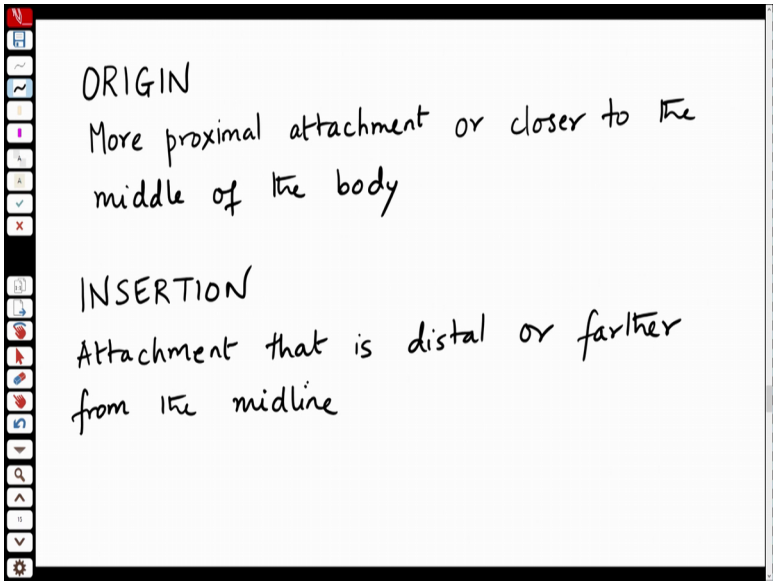

So, if you contract your gluteus maximus, in the back then you can produce thigh extension it is an extensor hip, extensor gluteus maximus is one of your hip extensors, but the way it acts it also that it also tends to rotate the thigh externally. Now, if that external rotation of the thigh is unwanted then a couple other muscles contract to internally let rotate that. So, that only your extension is left so, that is the purpose of a neutralizer muscle. So, if the external rotation is undesired then you have other muscles that.

Similarly in the arms also sometimes when you flex your arm then it may be accompanied by a supination action. So, the pronator may also act along with it to prevent that if you do not want that particular action we do not think about these things. So, much right, but that is what is happening the muscles are working synergistically to ensure that the desired movement is what is perfectly yes.

Student: So, in that case, let say with the stabilizer or neutralizer.

Yeah.

Student: Do we give control it or this is an indirect control or was it looks like it is more of a feedback right let say antagonise still going to have.

You will really look at the neuroscience of it to see you know we are not getting into the control aspects of the musculoskeletal system here, but in many cases we are. So, I can decide that I want to do this you know I can flex my elbow like this or like this. But I am making a conscious decision to flex it in a particular way, the muscles work with the neural system to ensure that things are activated such that my desired action happens.

But I think if you maybe look at through the course on neuroscience of human movement you might get the more detailed answers to these questions. And there, I am sure there are also areas of active research, because there is still a lot we do not know about how these things work, even the models these they are all approximate. And, they are all areas of very active research even the muscle action, you know the passive tension the hills muscle model people are constantly tweaking it people are constantly looking at how to understand the physiology of the muscle, and how to understand, how that translates into the actions that we see or that we think that we control so those are aspects of neuroscience.

So I think, with this I will you have a pretty good idea now of what we have done so far is that we have looked at the bones we have looked at the structure of the bones we have looked at how the bones come together to form different kinds of joints. And we have looked at how muscles influence the motion about those joints how they control.

Next we will start looking at specific areas of the body will start off with say the upper you know the arm. And then we will start looking at doing some analysis to understand water the sort of forces that are or the talks that a muscle has to generate to perform a certain task. We will start looking at some static analysis first essentially we will be applying the principles of mechanics to the structure of the human body you.