Ergonomics Research Techniques
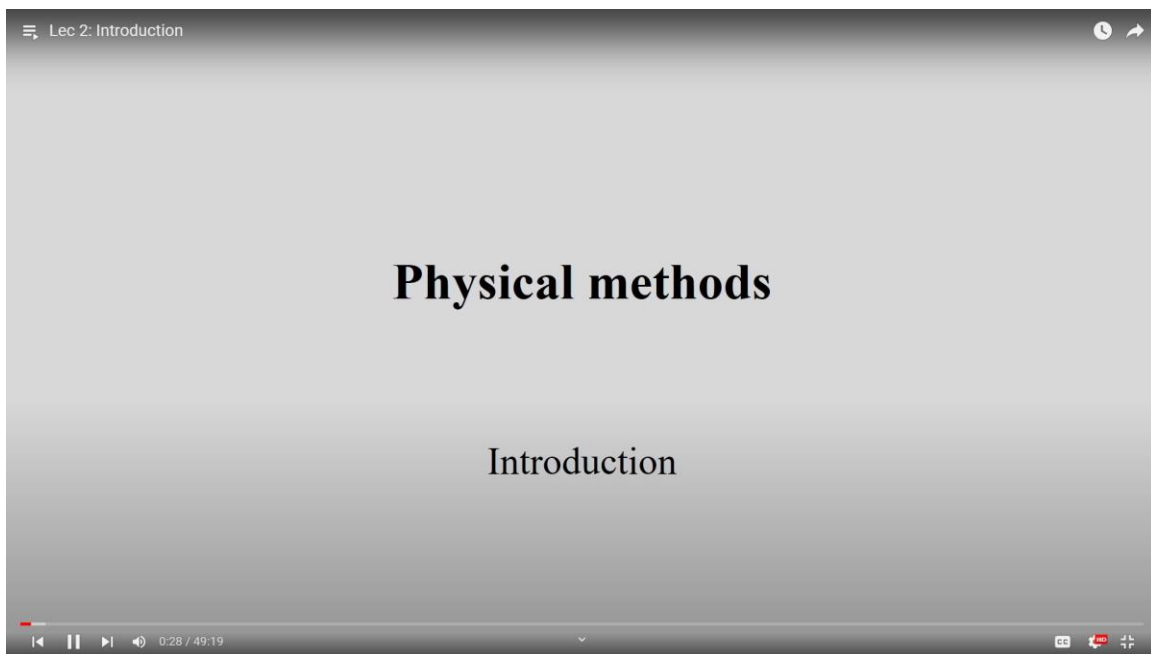
Urmi Ravindra Salve

Department of Design

Indian Institute of Technology (IIT) Guwahati

Week – 01

Lecture - 02

Lec 2: Introduction

Hello everyone, today we will start with the various physical methods. So, in today's session, what we will try to do is understand what varieties of physical methods are possible to conduct any kind of ergonomics workplace analysis and evaluation. When we talk about product evaluation and system evaluation, what are the varieties of physical methods available, and how do we practice them? So, in today's session, we will take an overview, and then from the next class onward, we will discuss each tool in detail, and we will take some examples as well.

- Used to assess the performance of work
  - How much crucial to the work
- Used to obtain essential surveillance data for the management of injury risks in workforce.
- Four major areas are assessed through physical methods

Introduction

Assessment of levels of musculoskeletal injuries

Assessment of posture during work performance

Assessment of work effort and fatigue

Assessment of possible injury risk in workplace

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So, let us understand what the physical method is, what the known varieties of things available in physical methods are, and why we call them physical methods. So, if you look at the major definitions of ergonomics and domains of ergonomics, we understand there is some component that talks about the physical domain of ergonomics, and the other parts talk about the cognitive domains of ergonomics.

Now, whatever things are being covered in the area or domain of physical ergonomics and when we are trying to measure them, assess them through some techniques and tools, we will call it the physical methods, and we will be considering, or we will try to explain it, or we will try to practice it in this particular set of lectures. So, if we talk about physical methods, we use them to assess work performance. Basically, we will try to understand the physical performance of a particular work. So, how crucial is that to work, and how is it used to obtain the essential surveillance data from the management of injury risk in that particular workforce?

So, whenever we talk about physical methods in ergonomics, we talk about a lot of things related to physical injury, physical hazards, physical hazards risk assessment, and all those things. So, if we look at look at these methods from a broader perspective, we will understand there are four basic major categories. Maybe these are these categories for our understanding. However, we can have some more categorization, or we can have subdivisions as well, but for our major understanding. So, for our broader understanding, we divide it into four major categories.

The first category talks about the assessment of levels of musculoskeletal injury. So,

whenever we are talking about physical methods in ergonomics, the first thing that comes to mind is musculoskeletal disorders or injuries or discomforts related to the musculoskeletal system. So, whenever we talk about the various assessments that give an understanding of the level of discrimination against musculoskeletal injuries, that comes first. The second part, which is very, very important and crucial when we are in the physical domain of ergonomics, is the posture and posture, which is related to work performance. So, posture is not maintained during laser time. We are going to talk mainly about posture, which is connected to work performance.

So, when you are doing some work, when you are performing some work, so, in an occupational setup, what are the kinds of postures we are adapting, how do we assess them, and what are the kind of impacts we may have due to such postures? So, this is second. Third is the assessment of work effort and fatigue. Now, when I am talking about physical methods in ergonomics. So, when somebody is physically active in a particular workplace or workspace, it is always that you know we need to understand what kind of fatigue is getting like you know how much fatigue the person is getting after completion of that work.

So, what is the kind of work effort he or she needs to put forward to complete the job and while doing so, how fatigue how what is the kind of you know what I can say what the kind of level of fatigue is is generated due to that kind of work exposure So, this is very very important portion and we have several methods several understanding about it, and we are going to discuss that same in that particular sector. And last that we are going to discuss in this particular sector is what are the possible injuries available or what are the possible injuries can be, you know, can come up or you know, due to the risky activities or risky jobs in that particular work environment or workplace. So, for four major categories, first, we will try to understand the musculoskeletal health of the worker and musculoskeletal injuries. Second, we will be talking about posture and the connection between posture and work performance. Third, we will talk about work effort and fatigue, and fourth, we will talk about the variety of possible injuries in the workplace. So, these are the primary four sectors that we are going to discuss in the area where we are talking about the physical methods in this particular course.

Now, let us understand the varieties of techniques or tools we are going to discuss in each sector. So, in today's class what we will do we will try to get an overview of the varieties of possible techniques that are available. Now, from the next class onwards, what we will do is pick up one tool, and we will practice it. So, that way, we will go into more detail because if you look at varieties of ergonomics research specifically, it is connected to varieties of occupational health and occupational risk. So, physical methods are very, very important, and for the new researchers in the field or ergonomics, you know, in the initial stage of their research is the physical risk assessment, different types of physical methods

through which they try to understand what are the varieties of physical ergonomics concerns are there in that particular work area.

So, understanding the physical domain in ergonomics is very, very important. So, in the assessment of the level of musculoskeletal injury under that mainly, we will be talking about musculoskeletal health and how we assess it. So, many musculoskeletal injuries begin where they begin, with the workers now experiencing discomfort. So, if you go to the initial stage of your data collection in any place, when you start with the physical method, it first comes what you know, the kinds of pain, discomfort, and strains are there you faced by the person or faced by the worker in a particular situation. So, the very first level of understanding is what kind of physical discomforts are available in that particular workplace that the worker faces.

So, if these types of things are being ignored. So, if someone is having back pain or neck pain, it is a very common discussion, right? So, if those are being ignored, that can lead to the risk factors responsible for those discomforts. So, you are not in a position. So, you are not actually understanding or listening to the kind of discomfort they have.

If you are not listening to the kind of discomfort they have, you will not be able to identify the causal factors or risk factors available in that particular workplace. So, understanding the level of discomfort at the initial stage of your evaluation is very, very important. This will further lead to an increase in the severity of the symptoms. So, if someone is saying on a 10-point scale that the discomfort is at a level of 2 or 3 and someone is saying at the

level of 7 or 8 and if you are not in a position to understand that and discriminate that and if you do not take any action on that then know the ultimate productivity or ultimate performance of that person will definitely go down, and ultimately the whole system will suffer. So, through these physical methods, we get an understanding of the kind of severities that are present in those symptoms or levels of symptoms. Then mild discomfort will gradually become more intense and will be experienced as an ache and pain.

So, this is a common feature. So, maybe in the initial days, it is not very difficult. You know you may try to ignore it. You mean the operator. The operator may try to ignore it. However, if we keep on ignoring it in the latter stage, maybe after a few years or a few months, it can cause a lot of pain and discomfort and severe discomfort. So, if these are not being checked, like not being corrected, then these aches and pains that signal come, you know what happen? It will cause the cumulative trauma.

So, small ignorance will cause a lot of problems and eventually may result in an actual musculoskeletal disorder or musculoskeletal injuries and serious nerve compression injuries. You may know that tendonitis, tenosynovitis, and carpal tunnel syndrome are the varieties of musculoskeletal disorders that can happen if you are not in a position on ergonomics to identify them in the initial stage of your evaluation. So, if we do not have any specific measurement tool or assessment tool to identify these musculoskeletal injuries, we will not be able to answer them in the correct way. Suppose there people is a lot of absenteeism in a particular workplace. You do not know the reasons for this absenteeism. The absenteeism may be something related to a job or physical discomfort.

Slide content:

≡ Lec 2: Introduction

Assessment of levels of musculoskeletal injuries

- Discomfort will also adversely affect work performance either by
  - Decreasing the quantity of work through increase error rate
  - Decreasing the quality of work through increase error rate
  - Both
- Reducing the levels of discomfort actually decrease the risk of an injury occurring.
- Changes in levels of discomfort can also be used to gauge the success of the design of
  - An ergonomic product
  - The implementation of an ergonomic program intervention.

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Now, if you do not have a proper tool or proper method to identify that, you will not be able to answer it. So, what will happen? You will be using this method that we are going to discuss. So, what are the kind of, you know, varieties of the questionnaire, varieties of, you know, tools or techniques? So, with this, you will understand where the problem lies and how it is possible for you, being an ergonomics professional, to answer it. Now, the discomfort will also adversely affect work performance either by decreasing the quantity of work through, you know, increased error rate, decreasing the quality of work through increased error rate, or both. Either quantity-wise or quality-wise, when you have an error, or it may happen both quantity and quality-wise, you are making some error, and you know there is a reduction in the whole performance.

That is why it is essential for an ergonomist in the initial stage, where a lot of physical activities are present in any occupational setup. You need to understand the varieties of problems that lie and how you measure them. So, before you go for the measures, you have to identify the levels and the varieties of those problems. So, reducing the level of discomfort actually decreases the risk of any injury occurring. So, if you initially reduce that discomfort itself, you are actually reducing the chances of the occurrence of those risks or injuries. So, changes in the level of discomfort can also be used to gauge the success of the design.

So, if you have a new design for any ergonomic product or the implementation of an ergonomic product inter-program intervention, ok. So, these are the benefits of using the physical assessment tool, and you can have a better workplace or better product design.

- Methods can be used to assess levels of musculoskeletal discomfort among workers-

Assessment of levels of musculoskeletal injuries

> PLIBEL

> U.S. NIOSH Discomfort Survey

> Dutch Musculoskeletal Survey (DMS)

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So, if we talk about musculoskeletal injury assessment and the level of that musculoskeletal injury, we majorly talk about pliable, NIOSH discomfort survey, and Dutch musculoskeletal survey. These are the three very strong tools that we use at the initial level if we want to identify or we want to assess musculoskeletal injuries. Now, these are not only the three tools. There are many other tools. I will name a few of them, and also, apart from that, there are many. Depending on the kind of objectives, you have to identify which tool is necessary for you.

Now, through this particular class, you will understand the basic information about this tool. Now, similar tools may also be available and may be very much connected to your objective. You need to choose that particular tool, not these tools. It absolutely depends on what your objective is and what those tools are talking about. So, it is not possible that all available tools I will be discussing majorly used tools only I will be discussing here. So, pliable, US NIOSH discomfort survey and Dutch musculoskeletal survey. So, let us understand what these are and what they talk about.
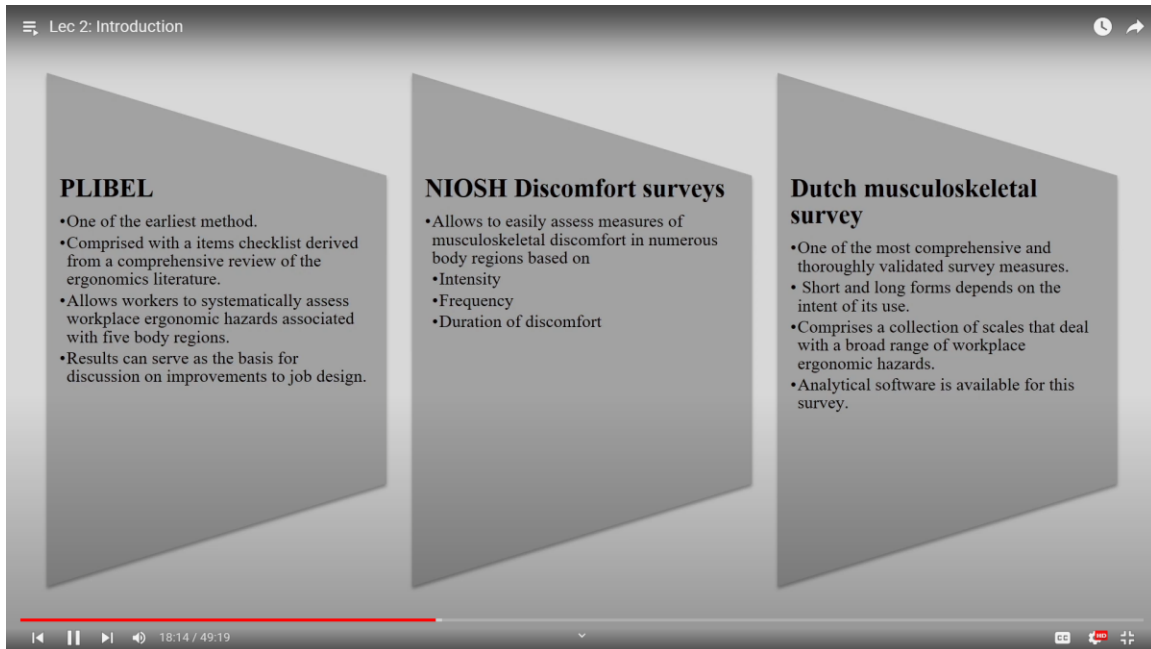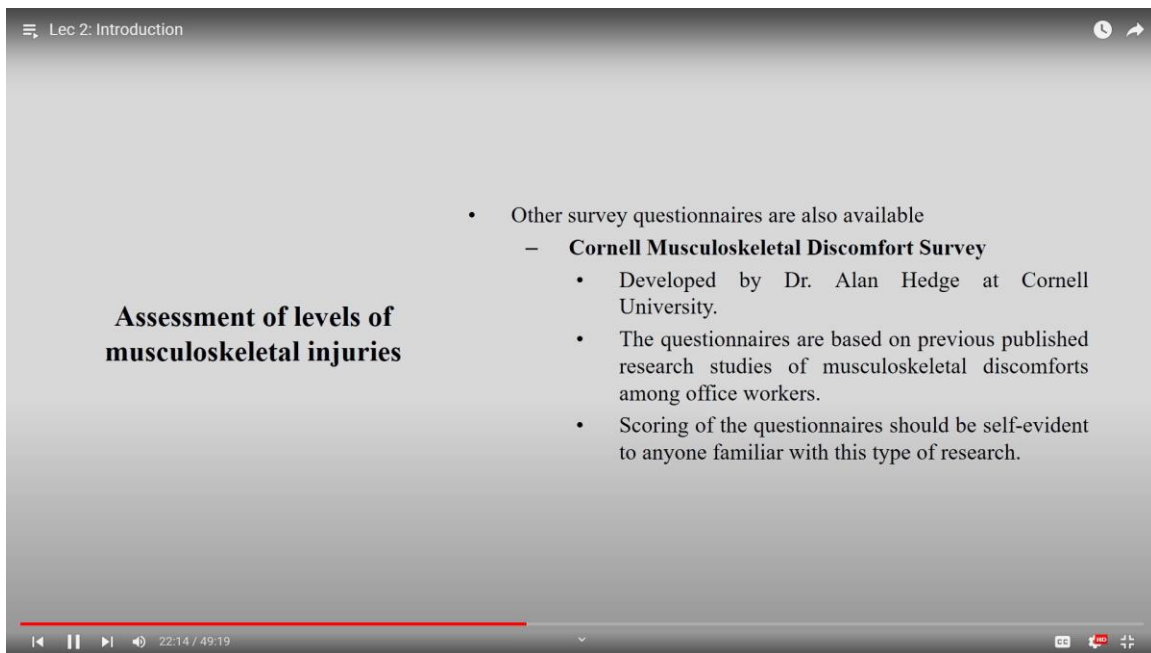
Of course, I will take you to the next class with more detail. So, what is pliable? It is one of the, you know, very easy methods, very, very easy methods, and it is also a very old method, early method, ok. So, comprised of an item checklist, you know there are varieties of items available derived from the comprehensive review of the ergonomics literature. So, what they have done is have a list of items in a particular checklist, and all these variables that are being discussed in this paper are derived from all musculoskeletal health-related literature. So, it allows workers to systematically assess the workplace ergonomics hazards associated with the five body regions that we are going to discuss, and results can serve as a basis for discussion on improvements to the job design.

So, the next major tool is the NIOSH discomfort survey. It is also a very popular tool, and you know it has a lot of testing related to reliability validity, and it is not very context-specific. So, that is why it is, you know, a very well-accepted tool. So, it says that it allows us to easily assess measures of musculoskeletal discomfort in numerous body regions based on intensity, frequency, and duration of discomfort. Three major components that is the intensity of the pain or intensity of the discomfort, frequency of the discomfort, and how long that discomfort is. So, under these three major categories, it tries to understand the discomfort level of that particular person in a particular environment.

So, that is all about the NIOSH discomfort survey. The third important tool in this particular section is the Dutch musculoskeletal survey. What does it say? It is one of the most comprehensive, very compact survey measures, and thoroughly validated. It is mainly a survey tool. Short and long forms depend on the intent of their use.

So, you know it has a very lengthy version as well. One lengthy version is almost about, you know, 16 pages, whereas you have a small version that has less content. So, depending on how intensely and rigorously you want to do the survey, you can choose any one of them. So, either short form or long form, it comprises a collection of scales that deal with a broad range of workplace ergonomics hazards. So, analytical software is also available with this particular survey tool because the author who developed this particular survey or this particular tool has software as well.
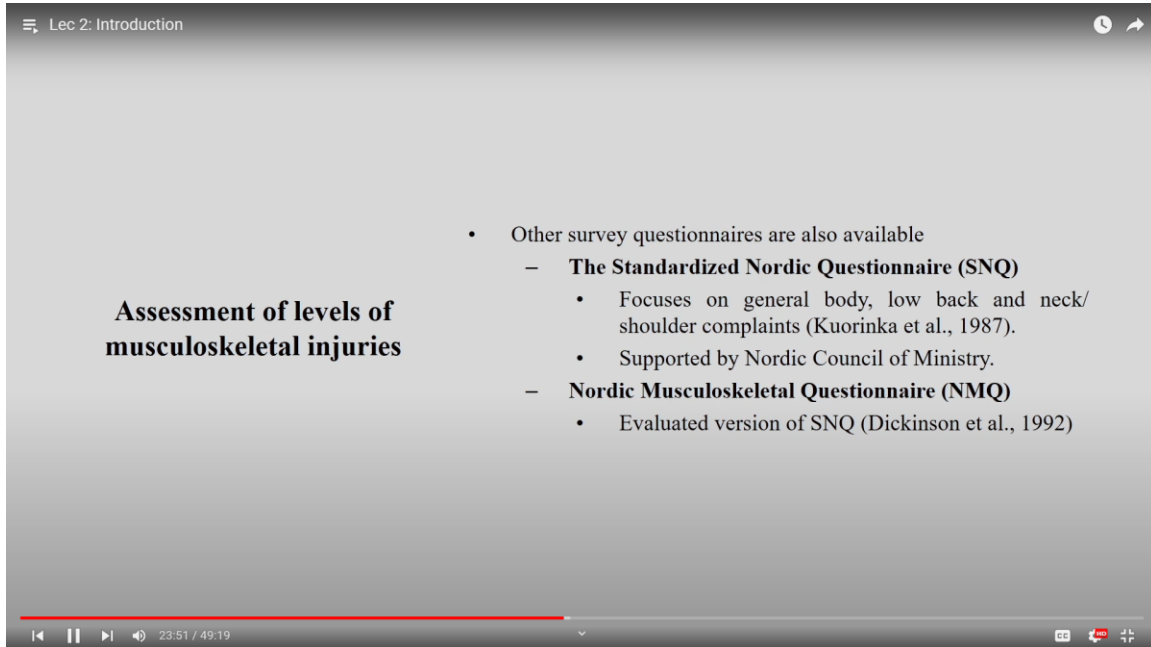
So, if you want you can buy it and you can use it. Otherwise, you can analyze it yourself, using a normal process in hard copy format. Apart from these three techniques, playable NIOSH survey questionnaire and the Dutch musculoskeletal questionnaire, there is one more important tool in this particular sector: the Cornell musculoskeletal discomfort survey. It was developed by Alan Hegue at Cornell University, which is why the name is the Cornell Musculoskeletal Discomfort Survey. These questionnaires are based on the various published literature or research studies on musculoskeletal discomfort among office workers. So, here, the concern is only office workers.

So, most people who are in the sedentary work population ok. So, it is not very applicable when somebody is working in a very physical activity like, you know, construction, then maybe on the shop floor or maybe somewhere in the automobile industry where a lot of physical activities are. In those cases, maybe it is not useful. However, it never says it is not useful. You need to validate it for your context, but mainly, it is developed for office

workers, and the scoring of the questionnaire should be self-evident to anyone familiar with this type of research.

So, that also you can use. One more important questionnaire very similar to these two was first developed in 1987, and then modified in 1992. So, the standard Nordic questionnaire, which was developed by Konica in 1987, is also a very simple method similar to the kind of you-know tool in the New York musculoskeletal disorder questionnaire. So, you can also have a rating, intensity level, or frequency for different body parts. Also, you try to get an understanding of the prevalence data in terms of point prevalence, weekly prevalence, and annual prevalence. The same one, like the standard Nordic musculoskeletal questionnaire, or Nordic questionnaire, was a little bit modified and published again in 1992, and it is termed a Nordic musculoskeletal questionnaire. Again, it is actually an evaluated version of SNQ.

So, these questionnaires are very, very popular, and I think whoever is working in the field of ergonomics, especially physical ergonomics, these are common today. So, these are the initial tools to correctly understand the status of musculoskeletal health in a particular workplace.

Assessment of posture

- Posture is an observable reflection of musculoskeletal activity.
- These methods all allow the ergonomist to assess risks by systemic observation alone.
- Can be performed on visual recording of workplaces
  - Videotapes
  - Photographs
- Neutral zone
  - Every body segments moves through a range of motion
  - Within this zone the anatomical stress and strains are insufficient to initiate an injury process.
- Excursions away from this neutral zone, the greater the injury risk .
- Frequently repeated and/ or sustained excursions for extended period, the injury risk will increased.
- Also identify the corrective action before the worker is exposed into discomfort.

Now, let us go ahead with the next step, which is the posture. So, whenever we talk about musculoskeletal health or musculoskeletal discomfort, it is associated with posture. So, if your posture is not correct, or I would rather say it is not neutral, it is awkward in nature you are, and you are continuing it for exposed hours. There will definitely be an impact on your musculoskeletal health.

 So, if you understand there is an issue with the musculoskeletal health or musculoskeletal injuries, which we can understand from our previous set of questions or previous set of techniques, definitely, it will lead you to evaluate your posture of or working posture of that particular group of people or a particular group of the worker. So, let us understand how we do that and what varieties of methods are available. So, posture is an observable reflection of musculoskeletal activity, of course, and how you are holding your musculoskeletal system. So, if you are sitting, what kinds of situations are available for your musculoskeletal system? What are the conditions of various muscles while sitting in a particular workplace, even if you are standing or lying on a bed? What kind of conditions are there for the whole musculoskeletal system? So, these methods will allow the ergonomist to assess the risk. You have to assess the risk by systemic observation alone.

 So, you have to do it systematically one by one, maybe initially neck, then trunk, then wrist, and then not only the position but also what kind of load it is carrying, what kind of frequency it is occupying, what is the kind of duration it is holding all the systematic observation or systematic evaluation. So, how do we do that? Mainly in the very initial days, we used to do on-the-spot observation. However, due to technological advancement, we can have videography, or you can have a photograph, and you can do the posture
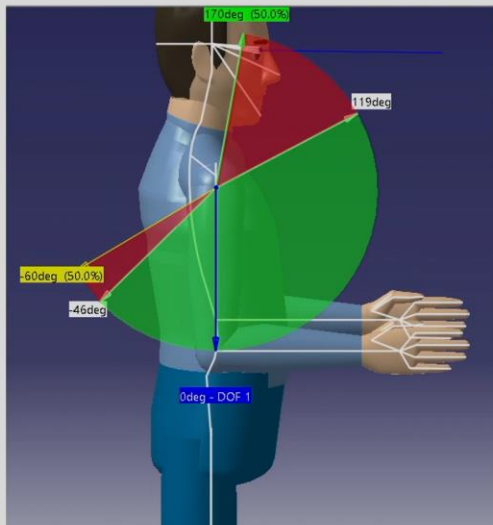
evaluation. Now, you need to understand the neutral zone. So, every segment moves through a range of motion, right?

So, suppose I am talking about my neck; this neck also has some specific range of motion. So, I can move forward, which is flexion, then I can move backward, which is an extension, side bending on the right side, and on the left side, I can rotate my neck, which is on the left side again, on the right side. So, in every angle, we have some kind of natural movement, not only for the neck, for the trunk, my elbow, my shoulder, and every joint, we can have some kind of range, right through where we can move those body parts, even our fingers, right? So each joint can move. So, everybody segment moves through its range of motion, which is very natural.

Within this zone, the anatomical stress and strain are insufficient to initiate an injury process. So, if they are in a particular zone, a natural zone, then there will be no difficulties or no problem. However, if it is extending or it is going beyond that particular zone, then there will definitely be some problems, and these posture evaluation tools will help you to understand those areas and what is the level of those problems. So, excursion away from this natural zone. If you are beyond that natural zone, if it is more than it is more, then the injuries are more; if it is less, injuries are less. So, what kind of level of distraction do you need to identify through these tools?

Also, frequently, the frequency of those postures. So, frequently repeated or sustained. So, here is a very important thing: if you have an awkward posture you are holding it for longer hours, then it is also a problem. Also, if you are occupying that repeatedly, then also it is a problem. So, you have to understand the optimum duration of exposure. So, posture itself is a problem or an issue to discuss, but when it is connected to your duration of exposure, it is again one more variable to identify and analyze.

Also, identify the corrective action before the worker is exposed to particular discomfort. So, these are the things we will be doing in the posture assessment. So, this is a figure that was developed in, you know, a digital human model in CATIA-V software. What here it tried to give you, know, tried to explain all these green zones, okay?

From the digital human model (manikin) seen in the figure:
- The total coloured areas indicate
  - Range of motion for flexion and extension of shoulder joint (right hand)
- The green coloured area indicates
  - Neutral zone
- The red coloured areas indicate
  - Beyond the neutral zone.
- Frequently repeated away from the green area or sustained excursion of right hand in any red areas for extended period
  - Increase the risk of musculoskeletal injury in shoulder joint.

Digital human model; developed in CatiaV5 software

Green zones are comfortable zones. These green zones are comfortable zones, whereas these red zones are not comfortable zones, dangerous zones, or risky zones. So, the total colored areas indicate the range of motion for flexion and extension of the shoulder joint only for the right hand. For this shoulder joint, this is the kind of possible movement region. This is totally possible, whereas green zones, as I mentioned earlier these green zones are neutral zones, and red zones are dangerous zones. Now, here, if someone is working in these green zones, they are definitely safe. However, if that is being continued for recommended hours, then that may create a problem.

- Methods can be used to assess the posture in workplaces-

Assessment of posture

| Quick Exposure Checklist |
| RULA |
| REBA |
| Strain Index |

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Whereas, if someone is working in these red zones, that itself is a problem, and if it is associated with more hours, then it is a bigger problem. So, frequently repeated away from this green area or, you know, sustained excursion of the right hand in any red areas for an extended period may cause an increase in the risk of musculoskeletal injury in that particular shoulder joint. So this way, we can understand it. Now, under this particular sector, which is the assessment of posture, we will be talking about the quick exposure checklist, or we call it QEC, Rula, or REBA. It is a very, very easy method and many of us already must have used it and the strain index. So, what these tools talk about, of course, we will take all these tools separately in the next class. For today's class, we will try to understand what these tools talk about.

So, a quick exposure checklist or QEC allows for a quick assessment of exposure to risk for work-related musculoskeletal disorders. It is used to analyze the interaction between various workplace risks. So, from QEC, we actually try to understand the workplace risk. First, what is the level of discomfort? Sorry, what is the level of risk? Then, what are the associated workplace factors that are causing the risk that we get from QEC? From Rula, it is a posture targeting method, and it helps us analyze sedentary work like, you know, seated posture.

So, Rula is essentially a tool that can evaluate a particular posture level, or, you know, the intensity of that posture only at this seat-sitting workstation. So, if you are sitting in a place where you know the table chair arrangement, then only Rula is applicable. If whole bodywork is there like somebody is, you know, using the whole body to do a particular job, that case, this particular tool is not applicable, and you have to go for REBA. The name itself says rapid entire body assessment. So, REBA REBA is, again, a posture-targeting tool that is ideal for standing work.

Standing one is whole body work. So, if you are not dynamic work, but if you are standing and doing the job. The strain index is a very comprehensive method, and it focuses on the risk of developing the distal upper extremities musculoskeletal disorder, specifically elbow, forearm, wrist, and hand. So, these are these are the four major methods that we will be discussing.

Assessment of posture

- Other similar posture targeting methods are-
  - **Ovako Working Posture Analysis System (OWPAS)**
    - Direct observation and sampling of tasks
    - Using a whole body posture coding system to estimate injury risk (Karhu et al., 1977).
  - **Portable Ergonomics Observation (PEO) method**
    - Records hand, neck, trunk and knee postures
    - Evaluates manual handling activities, e.g., lifting (Fransson-Hall et al., 1992)

Apart from that, we know we have the Ovako working posture analysis system, which we call OWPAS or OWAS, and the portable ergonomic observation method PEO. So, this OWAS, that is, the Ovako working posture analysis system, says direct observation and sampling. It talks about direct observation and does the sampling from the whole body posture coding system to estimate the injury risk.

So, this particular method actually developed in 1977. These RULA and REBA are very new methods, which were introduced in 1993. Yes, it is 1993. This is 2001. We probably need to check the year, but it is somewhere in 2000.

However, if you look at OWAS, it is 1977. It is a very old method. Still, people practice it. However, if you look at the current scenario, you know most of the works, you know industry 4.0 or any other context, if you look at the postures, are more sedentary in nature. So, RULA is a dominant tool in the current scenario. Now, coming to the work effort and fatigue, you understood all about musculoskeletal injury or musculoskeletal health assessment and then posture.

- The performance of work in more-deviated postures invariably requires more muscular effort.
- It may accelerate muscular fatigue .
- Two methods are included to quantify effort and fatigue.

Assessment of work effort and fatigue

Borg ratings of perceived execration scale

Muscle fatigue assessment method

Now, we are going to talk about work effort and fatigue. So, the performance of work in a more deviated posture invariably requires more muscular effort. It is obvious that if you have more deviation in posture, you need to exert more effort. And if you have more effort to perform to hold that particular posture, you are actually going to get fatigued. It may accelerate the muscular fatigue, of course. If you need a lot of effort to hold a particular posture, those groups of muscles will be fatigued after some time.

So, two major methods that we are going to discuss and which will help you to quantify the effort and fatigue are Borg's rating of perceived exertion scale and the muscle fatigue assessment method or MFA.

Borg ratings of perceived execration scale

A physiologically validated method

Quantifying how much effort is involved in performing physical work.

Muscle fatigue assessment method

Characterizes discomfort

Identifies the ways that workers change their behaviour in an attempt to cope with accumulated fatigue

- Both methods are invaluable to the successful design of physical jobs.

- Neither the quantity nor quality of work performance will suffer over the course of a work shift.

- The worker will not experience undue physical demands or fatigue that could increase the risks of an injury or accident.

So, what is Borg's rating of perceived exertion scale? So, it talks about the physiologically validated method. It is all about the physiologically validated method. I will discuss it like it has an RPE scale, the rate of perceived exertion, which is very much linear and which is connected to your heart rate. Whereas the CR10 scale is not connected directly to the heart rate.

However, it has an elaborate understanding of how it is being used and how it can tell you about the rate of exertion. It quantifies how much effort is involved in performing a particular physical task or physical job. Muscle fatigue assessment characterizes the discomfort and identifies the ways that workers change their behavior in an attempt to cope with the accumulated fatigue. So, if there is accumulated fatigue, because, of course, if you are continuing the work without a proper recovery period, there will be an accumulation in your fatigue level, and you will be able to get the discomfort, and you will be, that will reflect on your performance. So, this particular tool, the MFA, will help you understand these areas.

So, both these methods are invaluable to the successful design of any physical job. So, when you are talking about designing the work recycle or designing the timing of the work process, these tools are very, very helpful. So, it will help you to understand the pace of work; it will help you to understand what the kind of gap that needs to be from one step to another step, and what all those areas will help to recover any kind of fatigue from one job to another. So, all those things you can understand using these tools. Neither the quantity nor quality of work performance will suffer over the course of a work shift if you use this tool to assess the situation and implement a proper intervention program.

So the worker will not experience undue physical demands or fatigue that could increase the risk of any injury or accident.

Now, the last portion of the physical assessment is the injury risk in the workplace, whatever the possible identification and assessment of the possible injury risk in the workplace. So, we will be talking about these mainly as they are related to a lot of physical activity.   So, Snook Stable, Lumber Motion Method, OCRA, and Mapo.

 These four we will be discussing. However, there are many more. It is like, it is a pool, it is a big pool. So, you can choose any one of them that is similar to these, or that is more context-specific to your area of research, okay? However, we will be discussing these four because they are the tools that are used most. So, such methods are used to predict the risk of potentially accurate injuries, mainly related to the back. They are, set safe limits on work and predict how changes in a job will impact the level of safety.

Snook tables	• Assessing back injury risk. • It set safe weight limits for men and women, performing lifting, pushing and pulling tasks at work.
Lumber motion method	• Providing more direct assessment of the dynamic components of low back disorder risks at work.
OCRA	• A detailed analytical and reliable method. • Predictive of upper-extremity injury risks in exposed worker populations. • Used as the basis for identifying opportunities for task and/ or workstation redesign, evaluating the success of any intervention.
MAPO	• Developed to analyze health-care workplaces. • Assessing the greatest risks for developing a low-back injury • For workers involved in care and handling of disable patients, paralyzed patients. • Also incorporates an assessment of the work environment

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So, let us understand what Snook Stable is. It mainly tries to assess the back injury risk. Possible risk for a back injury that it tries to give you an understanding. It sets safe weight limits for men and women who are performing, you know, lifting, pushing, pulling, and all these varieties of tasks. So, it gives an understanding of what should be the limit of a person if they are performing any pulling, lifting, lowering, or all those such types of jobs. Lumber Motion Method, by the name itself, you can understand that it talks about your trunk and your lower back.

So, it is a very instrumental method. You need to have those instruments with you. So, it provides a more direct measurement of the dynamic components of low back disorders at work. So, it is based on a system called Lumber Motion Monitor. We will describe it. So, using that, we will get a more detailed understanding of the major risks available or the factors affecting your lower back in a particular workplace. OCRA is a detailed, analytical, and reliable method. It predicts the upper extremity injury risk in the exposed work population, and it is used as the basis for identifying the opportunities for task and workstation redesign and evaluating the success of any intervention.

Now, here you can understand what you do from the Snook table. It only helps you to understand the pulling, pushing, lowering, and all these types of jobs that are related to some weight lifting. The Lumber Motion Method helps you understand only the lower back and the risk associated with the lower back. OCRA helps you to understand only the upper extremity, mainly the distal upper extremity. Meanwhile, MAPO mainly concentrates on the healthcare workplace in hospital situations. So, actually, it is developed in that

particular setup to assess the greatest risk of developing a lower back injury.

It talks about the lower back, but mainly from the healthcare sector for workers involved in the care and handling of disabled patient and paralyzed patients. Now, people may ask why LMM is not available. Why MAPO? Now, the question is, LMM never talks about the human interaction between one person, the handler, and the handling element. Meanwhile, MAPO talks about the healthcare worker and the human factors that are present while handling patients. So, there is a difference. So, it is not only handling some weight, it is not only handling some material, it is handling human ok.

That is why it is very, very different from any other tool. It also incorporates the assessment of the work environment. So, MAPO is very very specific to the healthcare facilities. So, these are the major tools that we are going to discuss. However, I will name many more. Whereas you have to take them up by yourself, you have to study them up by yourself to understand the details, if required.

If required, you can definitely get back to us in a discussion session. You can write back to us at whatever the email IDs and discussion forums are, and we can definitely give you the solution. Because in this particular course, it is really not possible to cover each and every tool available in the literature. We are going to discuss whatever tool is used most. And from the next class onwards, what will I do? I will take one tool separately, and I will explain to them their process, their implementation, how the data looks, what is the possible way to interpret them, and how to start the intervention based on those interpretations. So, thank you for today. In the next class, we will start with each tool. Thank you.