Advanced Anatomy & Physiology

Unit 3 – The neuromuscular and endocrine systems

Lesson 3.6 – Neuromuscular Coordination
Step 1 – Aims

This lesson will enable you to:

- Explain the concept of neuromuscular efficiency
- Create exercise programmes to enhance your clients’ levels of neuromuscular efficiency

Step 2 – Introduction

Now that you have an understanding of the structure and function of the nervous system and its adaption to exercise, let’s look at how you can enhance the efficiency of the neuromuscular system to improve exercise performance.

We’ll begin by looking at the concept of neuromuscular efficiency.

Step 3 – Neuromuscular efficiency

Neuromuscular efficiency, or coordination, is the ability of the nervous system to communicate effectively with the muscular system. This allows the muscles to perform their roles effectively, as optimal movement requires muscles to reduce force eccentrically, stabilise isometrically and produce force concentrically.

Step 4 – Neuromuscular efficiency

For example, when you perform a squat, your hip and knee extensors must work eccentrically on the downward phase to control your descent. They must then work concentrically as you extend your hips and knees to return to the start position. Throughout the whole of the movement your core stabiliser muscles are working isometrically to stabilise your core.

For this to happen, the right type of muscular contractions must occur at the correct force and at the right time of the movement. Additionally, the nervous system must inhibit the antagonists sufficiently to relax them so that they do not offer unnecessary resistance to the movement.

This not only involves inter-muscular coordination (the coordination between different muscles), but also intra-muscular coordination to ensure the optimal physiological processes occur within the muscles.

Step 5 – Neuromuscular efficiency

Enhanced neuromuscular efficiency can provide a number of benefits for exercise performance. These include reduced energy expenditure, increased force production and stability, and a reduced risk of injury.
Step 6 – Training for optimal neuromuscular efficiency

Now that you have understanding of what neuromuscular efficiency is and the benefits it can provide, let’s turn our attention to how you can create exercise programmes to enhance it.

The traditional approach to training has been to focus on gains in absolute strength and endurance, employing exercises that target isolated muscles using single planes of motion. However, functional activities often occur in a number of planes. They also involve multi-joint movements and require not only strength and endurance, but also acceleration, deceleration and stabilisation.

Step 7 – Training for optimal neuromuscular efficiency

Consider the example of a tennis player. She must produce high levels of concentric force when hitting the ball, be able to quickly accelerate and decelerate when moving around the court and have sufficient stability to optimise performance and reduce the risk of injury.

These functional demands need to be reflected in her training programme if she is to achieve the best possible results. This involves training the muscles and nervous system to perform all of their roles effectively, that is, to reduce force eccentrically, stabilise isometrically and produce force concentrically, using predominately multi-joint exercises in a variety of planes.

Step 8 – Training for optimal neuromuscular efficiency

Balance training can also be an important part of a training programme because whether you’re playing tennis, performing a power clean or walking down the stairs, balance plays a role in the safe and effective performance of many functional activities.
By placing a client in an unstable environment, such as on a wobble board, you increase the amount of sensory feedback into the nervous system, which can help to optimise neuromuscular efficiency.

**Step 9 – Activity**

Use the words from the list below to complete the statement.

- Concentrically
- Coordination
- Eccentrically
- Isometrically
- Movement
- Muscles
- Muscular
- Nervous

Neuromuscular efficiency, or ………., is the ability of the ……….. system to communicate effectively with the …………… system. This allows the ……………to perform their roles effectively, as optimal …………… requires muscles to reduce force ……………., stabilise …………… and produce force ……………….

**Step 10 – Activity**

Is the statement true or false?

One of the benefits of enhanced neuromuscular efficiency is a reduction in energy expenditure.

**Step 11 – Activity**

Choose the correct answer.

Placing someone in an unstable environment, such as on a wobble board, increases the amount of what into the nervous system, which helps to optimise neuromuscular efficiency?

- Sensory feedback
- Optimal movement
- Concentric force

**Step 12 – Summary**

Now that you have completed this lesson you will have a better understanding of the following:

Neuromuscular efficiency is the ability of the nervous system to communicate effectively with the muscular system.
The benefits of enhanced neuromuscular efficiency include reduced energy expenditure, increased force production, enhanced stability, and a reduced risk of injury.

Functional activities usually occur in a number of planes. They also involve multi-joint movements and require not only strength and endurance, but also acceleration, deceleration and stabilisation.

These functional demands need to be reflected in your clients' training programmes if they are to achieve the best possible results. This involves training muscles to reduce force eccentrically, stabilise isometrically and produce force concentrically using predominately multi-joint exercises in a variety of planes.