EXPLOSIVE ENERGY: INSIDE THE SCIENCE OF ATHLETIC POWER GENERATION!

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INDUSTRY INSIDER | #011

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Jonathan has been involved with NSCA and previously served on numerous committees and special interest groups and has spoken at over 60 events including many for NSCA, and ISSN, NASM, and numerous other fitness organisations.

Jonathan has authored numerous peer-review and scientific publications and has written 10 book chapters related to sports nutrition and strength and conditioning.

Jonathan is a sought-after presenter nationally and internationally. He is currently writing a book for Human Kinetics on Strongman Training for Strength and Performance.

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INSIDE THE SCIENCE OF ATHLETIC POWER GENERATION!

The science of power production is a cornerstone concept in the realm of strength training, providing coaches and trainers with a deep understanding of how to optimise athletic performance.

At its core, power production involves the ability to exert maximal force in minimal time. This intricate interplay of force and velocity is described by the force-velocity curve, a key principle that illustrates the balance needed between strength (force) and speed (velocity) for effective power generation.

Coaches and trainers need to be well-versed with the mechanisms of power production, rotational power, and the role of anatomical subsystems in achieving desired performance outcomes.

This knowledge forms the principles of training program design, enabling the development of tailored strategies that can significantly enhance an athlete's or client's ability to perform and excel in their respective sport or fitness goals.

WHAT IS THE FORCE-VELOCITY CURVE AND WHY IS IT IMPORTANT IN SPORTS PERFORMANCE?

The force-velocity curve is a fundamental concept in biomechanics that illustrates the inverse relationship between force and velocity during muscle contraction. In simple terms, the more force (resistance) a muscle is required to exert, the slower the resulting contraction (movement) will be, and conversely, the less force required, the faster the contraction can be.

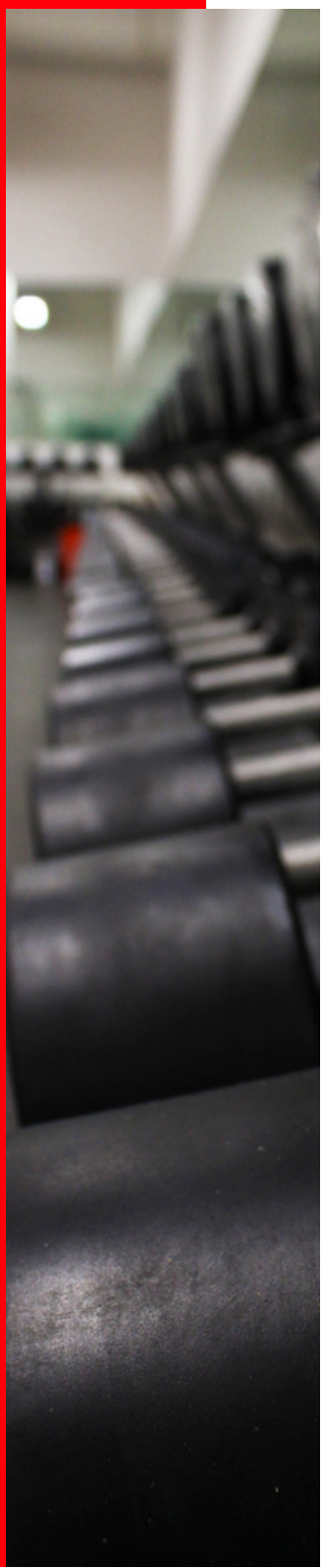
Understanding this curve is vital for sports performance as it helps coaches and trainers design training programs that can target specific areas of the curve to improve an athlete's performance in their particular sport.

WHAT IS POWER PRODUCTION AND ROTATIONAL POWER IN THE CONTEXT OF WORKOUTS, AND WHY ARE THEY IMPORTANT?

Power production in workouts refers to the ability to generate force quickly. It's a crucial aspect of athletic performance, particularly in sports where sprinting, jumping, or explosive movements are needed.

Rotational power, on the other hand, is the ability to produce force in a rotational manner. It's essential in activities that require twisting movements, like golf, baseball, and tennis. Incorporating power production and rotational power into your workouts can enhance your overall athleticism, improve balance and coordination, and reduce the risk of injury by ensuring that the body can handle various movement patterns effectively.

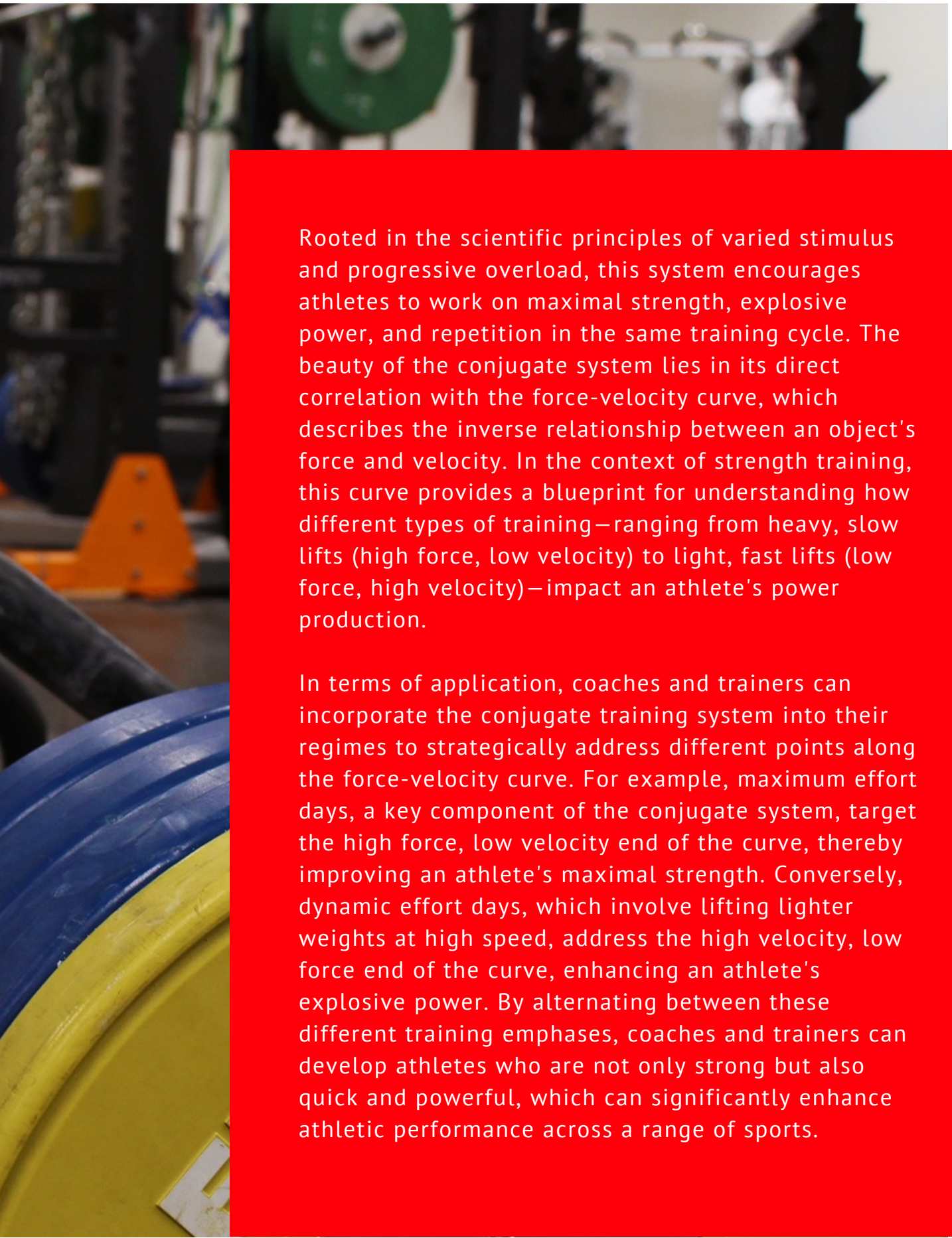
HOW CAN COACHES AND TRAINERS USE THE FORCE-VELOCITY CURVE TO DESIGN TRAINING PROGRAMS?



Coaches and trainers can use the force-velocity curve to help tailor an athlete's training program to their specific needs. For instance, if an athlete needs to improve their maximum strength (the ability to generate high force regardless of speed), the trainer can design a program that includes heavy resistance training which targets the high-force end of the curve. Conversely, if the athlete needs to improve their speed or power (the ability to generate high force quickly), the trainer can design a program that includes plyometric or ballistic exercises that target the high-velocity end of the curve.

Power, in a biomechanical sense, is the product of force and velocity. It's the ability to exert force quickly. The peak of the force-velocity curve represents the maximum power an athlete can produce. Training to improve power often involves exercises that target this area of the curve, such as plyometrics or weightlifting exercises with moderate loads performed at high speed. This can improve an athlete's ability to perform explosive movements, which are crucial.

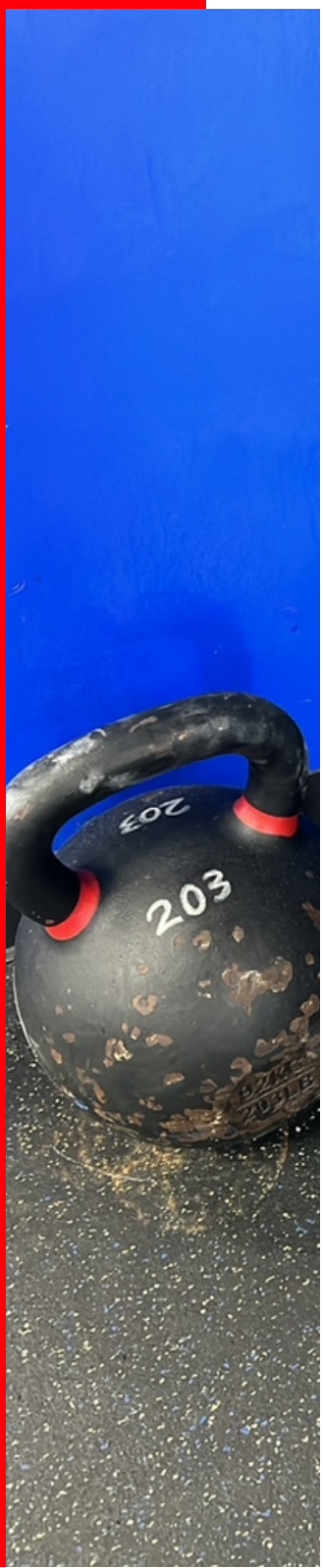
If we extend this out further, we can discuss the Conjugate Training System. Often associated with powerlifting but applicable across various sports. It's a comprehensive approach to strength and conditioning that aims to develop multiple physical capabilities simultaneously.



Rooted in the scientific principles of varied stimulus and progressive overload, this system encourages athletes to work on maximal strength, explosive power, and repetition in the same training cycle. The beauty of the conjugate system lies in its direct correlation with the force-velocity curve, which describes the inverse relationship between an object's force and velocity. In the context of strength training, this curve provides a blueprint for understanding how different types of training—ranging from heavy, slow lifts (high force, low velocity) to light, fast lifts (low force, high velocity)—impact an athlete's power production.

In terms of application, coaches and trainers can incorporate the conjugate training system into their regimes to strategically address different points along the force-velocity curve. For example, maximum effort days, a key component of the conjugate system, target the high force, low velocity end of the curve, thereby improving an athlete's maximal strength. Conversely, dynamic effort days, which involve lifting lighter weights at high speed, address the high velocity, low force end of the curve, enhancing an athlete's explosive power. By alternating between these different training emphases, coaches and trainers can develop athletes who are not only strong but also quick and powerful, which can significantly enhance athletic performance across a range of sports.

WHAT ARE ANATOMICAL SUBSYSTEMS AND CAN YOU EXPLAIN EACH OF THE FOUR MAIN ANATOMICAL SUBSYSTEMS & WHY ARE THEY IMPORTANT IN TRAINING PROGRAMS?



Anatomical subsystems refer to groups of muscles that work together to create and control movement. These include the anterior oblique subsystem, posterior oblique subsystem, lateral subsystem, and deep longitudinal subsystem. Understanding these subsystems is important for designing effective training programs because it helps to ensure that exercises are targeting the right groups of muscles and contributing to balanced, functional movement patterns. The four main anatomical subsystems include:

1. The anterior oblique subsystem (AOS) includes the external oblique, internal oblique, and adductor muscles. This subsystem is critical for transferring forces between the upper and lower body, especially during rotational movements.

2. The posterior oblique subsystem (POS) includes the gluteus maximus, latissimus dorsi, and thoracolumbar fascia. Like the AOS, it's involved in transferring forces between the upper and lower body, but it's particularly active during movements that require extension and rotation, such as throwing a ball.

3. The lateral subsystem (LS) includes the gluteus medius, adductors, and quadratus lumborum. It's crucial for frontal plane (side-to-side) stability, particularly during single-leg movements.

4. The deep longitudinal subsystem (DLS) includes the erector spinae, biceps femoris, and sacrotuberous ligament. This subsystem is involved in controlling forces that act along the body's length, particularly during running and jumping movements.

CAN YOU PROVIDE SOME EXAMPLES OF EXERCISES THAT TARGET EACH OF THESE SUBSYSTEMS?

1. For the anterior oblique subsystem, exercises like the medicine ball rotational throw, standing cable rotation can be effective.

2. The posterior oblique subsystem can be targeted with exercises like single-arm dumbbell rows or deadlifts, rotational sled pulls and pushes which engage both the latissimus dorsi and the gluteus maximus.

3. The lateral subsystem can be trained with exercises like lateral lunges, side planks, or single-leg squats, and many others, which require frontal plane stability.

4. For the deep longitudinal subsystem, exercises like kettlebell swings, sprinting single-leg or Romanian deadlifts can be particularly beneficial.

HOW CAN ONE EFFECTIVELY INCORPORATE POWER PRODUCTION INTO THEIR WORKOUTS?

To incorporate power production into your workouts, you can use Plyometric exercises or Olympic lifts.

Plyometric exercises, like box jumps or plyo-push-ups, involve quick, explosive movements that train your muscles to produce maximum force in a short amount of time.

Olympic lifts, such as the clean and jerk or the snatch, also focus on power production.

There are several exercises that can enhance your rotational power including rotational cable rows, medicine ball rotational throws, and kettlebell movements are all great options.

Additionally, incorporating specific sports drills, like swinging a baseball bat or golf club, can also help develop rotational power specific to those activities.

IS THERE A SPECIFIC ORDER IN WHICH POWER PRODUCTION AND ROTATIONAL POWER EXERCISES SHOULD BE INCORPORATED INTO A WORKOUT?

Power production and rotational power exercises are typically more demanding on the nervous system and require a high level of skill and technique.

Therefore, they are generally best performed at the beginning of a workout after a specific upper, or lower body warm-up or based on what the client or athlete programming entails. This allows for maximum force production and minimises the risk of injury.

Learn more about Dr Jonathan Mike online
https://drjmike.com/

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