UEM
UNIVERSITY OF ENGINEERING & MANAGEMENT
श्रद्धावान लभते ज्ञानम्
Good Education, Good Jobs

September 2024

Issue

PHYSIO-PULSE @UEMJ

Biomechanics and Beyond: The Science of Motion"

10+

Top National Achievements

TOP

Sep 2024
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SEPTEMBER 2024

Student Co-Ordinator

MEGHA HARTIWAL

RADHIKA SAINI

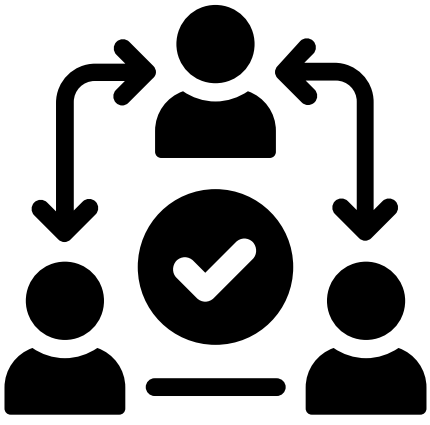
KHUSHBU SAINI

PRIYA SHARMA

MANISHA CHOUDHARY

MANISHA SAINI

SWAPNALINA PAUL



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September 2024 | Issue

Teacher's Day

Celebration 2024

PHYSIOTHERAPY WEEK 2024

Awareness Sessions, Camps, Quiz and many more

PHYSIOTHERAPY WEEK 2024

Awareness Sessions, Camps, Quiz and many more

PHYSIOTHERAPY CAMP

8th September, 2024

"Celebrating Physiotherapy Week: UEM Students lead the way in health awareness and care at the physiotherapy camp – September 8, 2024."

DEPARTMENTAL ACTIVITES

QUIZ COMPETITION

Department of Physiotherapy has organized an intercollegiate quiz competition during Physiotherapy week Celebration

STUDENTS PARTICIPATED FROM VARIOUS COLLEGES FROM JAIPUR

Student's Participation

Spinal Aid Symposium

Mendanta Medi-city, Gurugram

Empowering Future Leaders in Physiotherapy: UEM Students Shine at the Spinal Aid Symposium, Medanta MediCity – September 15, 2024

FRESHER'S PARTY

"Swagat 2.0: A Grand Welcome to the New Batch! Congratulations to Miss Freshers 2024 from BPT a UEM Jaipur – Unveiling New Beginnings on September 13th, 2024."

An evening filled with energetic performances, ramp walk and more..

HAND'S-ON TRAINING

"Hands-On Learning in Critical Care: UEM Students Excel at the Workshop on Ventilator Training and ICU Management, Enhancing Their Skills for Future Challenges."

Resource Person:
Dr Nandini Kushwaha

Mastering Moves: Students shine in Chess

CHESS COMPETITION 2024

"Battle of Minds: Inter-College Chess Championship 2024"

On September 7, 2024, the University of Engineering and Management Chomu hosted an inter-departmental chess competition as part of Physiotherapy Week. Organized by Dr. Vishnuraj Nair, the event aimed to promote strategic thinking and foster interaction between departments. BTech students participated enthusiastically, showcasing their chess skills and competitive spirit. Student Coordinators Rakesh and Jitendra, both third-year physiotherapy students, played a key role in managing the event smoothly. The chess competition not only highlighted student talent but also strengthened the university's sense of community.

SEP ISSUE

WHITE COAT AND OATH TAKIGN CEREMONY

Marking a Milestone: UEM BPT Students Embark on Their Professional Journey with Pride at the White Coat and Oath-Taking Ceremony."

"Honouring Tradition and Responsibility"

Students embrace the values of *Care and Commitment* as they step into the *World of Healthcare*.

ACHIEVEMENTS

Dr. Imran Khan, Assistant Professor in the Department of Physiotherapy at the University of Engineering and Management, has been honoured with the prestigious Academic Excellence Award at the Spine Aid Symposium 2024. The symposium, held on September 15, 2024, at Medanta, focused on the theme "Recent Advancements in Spine Rehabilitation."

Dr. Imran Khan from the Department of Physiotherapy, UEM Jaipur, was honored as the Best Researcher at the 3rd International Osteopathy & Manual Therapy Conference – OSTEO MANUAL SUMMIT 2024, held in New Delhi on World Physiotherapy Day. The event focused on the theme "Exercise is Medicine" and brought together global leaders in the field. Dr. Khan, who also served as the Scientific Chairperson for the conference, expressed gratitude to the Organizing Committee for the recognition and his role in shaping the conference's scientific direction.

Dr. Gaurav Shrivasta, Associate Professor , Department of Physiotherapy at UEM University Jaipur has attended the international conference. The theme of the conference was Exercise in medicine .He also has been Honoured with an Best Academician award in 3rd International osteopathy & Manual Therapy conference "OSTEO MANUAL SUMMIT" 2024 on 8th sept in New Delhi on the world Physiotherapy day.

RECOGNIZING EXCELLENCE: DR. SEEMA HONORED FOR HER CONTRIBUTIONS TO SPINAL CARE AT THE SPINAL AID SYMPOSIUM, MEDANTA MEDICITY

HELD ON 15TH SEP 2024

Dr. Seema was honored at the prestigious Spinal Aid Symposium held at Medanta MediCity for her exceptional contributions to spinal care and rehabilitation. Her dedication to advancing physiotherapy in the field of spine health, particularly in India, has made her a respected figure among her peers.

CELEBRATING LEADERSHIP AND INNOVATION IN SPINAL CARE: DR. NEHA'S IMPACT RECOGNIZED AT MEDANTA MEDICITY

Dr. Neha Vyas was honored at the prestigious Spinal Aid Symposium held at Medanta MediCity for her remarkable contributions to spinal care and physiotherapy. Her dedication to advancing patient care and her expertise

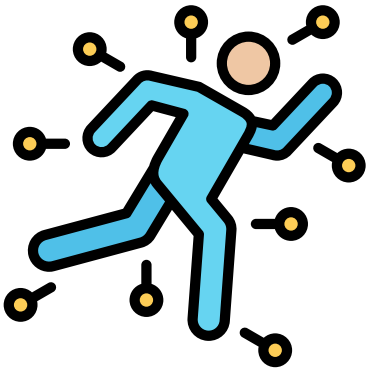
Student's Corner

BIOMECHANICS AND BEYOND: THE SCIENCE OF MOTION

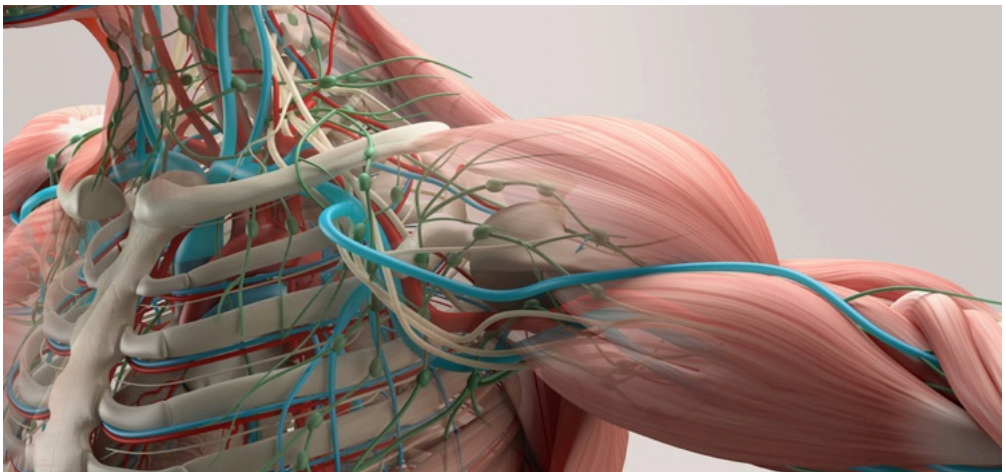
MS. SWAPNOLINA PAUL
MPT STUDENT
UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

BEYOND THE MOITON

The human body is capable of performing infinite variety movements. Human movement remains a complex and multifaceted mystery, influenced by a dynamic interplay of biomechanical, neurological, and environmental factors. This paper aims to understand briefly the human body movement, exploring the latest advances in biomechanics, planes and axes and arthrokinematics. we can gain a deeper understanding of human function, develop innovative strategies for movement rehabilitation uncover new insights into the remarkable capabilities of the human body



The anatomical position is the point of reference for all movements. In the anatomical position, the body is upright with the arms by the sides, shoulder in neutral rotation, palms facing forward, elbows and fingers extended and the thumbs in an adducted position with the thumb pads facing forward. The lower limbs are straight, the feet slightly apart with the second toe facing forward. The standard anatomical position provides an understandable and accurate way of describing human anatomy, physiology and joint planes and axes. It is also the zero position when measuring range of motion. (Cameron MH, Monroe LG. 2008).



AXES OF MOVEMENT

A sagittal plane, also known as the longitudinal plane, is perpendicular to the ground and divides the body into left and right. The midsagittal or median plane is in the midline i.e. it would pass through the midline structures, and all other sagittal planes are parallel to it.

A coronal or frontal plane is perpendicular to the ground and divides the body into dorsal and ventral portions. A transverse plane, also known as an axial plane or cross-section, divides the body into cranial and caudal portions. It is parallel to the ground, which separates the superior from the inferior, the head from the feet. When describing anatomical motion, these planes describe the axis along which an action is performed.

An axis is a straight line around which an object rotates. Movement at the joint takes place in a plane about an axis. There are three axes of rotation. Sagittal axis, passes horizontally from posterior to anterior and is formed by the intersection of the sagittal and transverse planes. Frontal axis, passes horizontally from left to right and is formed by the intersection of the frontal and transverse planes. Vertical axis, passes vertically from inferior to superior and is formed by the intersection of the sagittal and frontal planes.

ANATOMICAL MOVEMENTS

Anatomic terms describing human movement are independent of viewer perspective and, therefore, more useful clinically. Because there are two directions of rotation (positive and negative) around each of the three cardinal axes, we can describe three or six pairs of anatomic rotations available to body segments. Flexion and extension occur in the sagittal plane around a coronal axis, although exceptions exist. Anatomically, flexion is the direction of segmental rotation that brings ventral surfaces of adjacent segments closer together, and extension is the direction of segmental rotation that brings dorsal surfaces closer together.

Abduction and adduction of a segment occur around the A-P axis and in the frontal plane but in opposite directions. Anatomically, abduction brings the segment away from the midline of the body, whereas adduction brings the segment toward the midline of the body. When the moving segment is part of the midline of the body, the rotary movement is commonly termed lateral flexion (to the right or to the left).

Medial (or internal) rotation and lateral (or external) rotation are opposite motions of a segment that generally occur around a vertical (or longitudinal) axis in the transverse plane. Anatomically, Medial rotation occurs as the segment moves parallel to the ground and toward the midline, whereas lateral rotation occurs opposite to that. When the segment is part of the midline, rotation in the transverse plane is simply called rotation to the right or rotation to the left.

ARTHROKINEMATICS

Arthrokinematics describes the motion that occurs between the articular surfaces of joints. Most joint surfaces are curved with one surface being relatively convex and one relatively concave. The convex-concave relationship of most articulations improves their congruency, increases the surface area for dissipating contact forces, and helps guide the motion between the bones.

The three fundamental movements exist between joint surfaces roll, slide and spin.

Primarily bone rotates through space is by a rolling of its articular surface against another bone’s articular surface. The motion is shown for a convex-on-concave surface movement at the glenohumeral joint in. The contracting supraspinatus muscle rolls the convex humeral head against the slight concavity of the glenoid fossa. The roll directs the osteokinematic path of the abducting shaft of humerus. A rolling convex surface typically involves a concurrent, oppositely directed slide. The inferior-directed slide of the humeral head offsets most of the potential superior migration of the rolling humeral head. The offsetting roll-and-slide kinematics is analogous to a tire on a car that is spinning on a sheet of ice.

Dynamic Stability of Glenohumeral Joint

The dynamic stability of the glenohumeral (shoulder) joint is crucial for maintaining proper alignment and function during various movements. This stability is largely dependent on the coordinated efforts of muscles, tendons, and the nervous system.

The glenohumeral joint, a ball-and-socket joint, consists of the head of the humerus fitting into the shallow socket of the scapula, known as the glenoid. Dynamic stability is vital for ensuring the shoulder joint operates efficiently and effectively, particularly during movement.

Key contributors to the dynamic stability of the shoulder joint include:

1. Rotator Cuff Muscles: These four muscles—supraspinatus, infraspinatus, teres minor, and subscapularis—serve as the primary dynamic stabilizers. They surround the shoulder joint and generate compressive forces that help keep the humeral head centered within the glenoid cavity. Their coordinated contractions are essential for preventing excessive movement of the humeral head, particularly during dynamic activities.

2. Scapular Stabilizers: Muscles such as the serratus anterior, trapezius, rhomboids, and levator scapulae play significant roles in stabilizing the scapula. Proper positioning of the scapula is critical for creating a stable base for the glenohumeral joint, allowing for efficient movement. Dysfunction in scapular movement can lead to impaired shoulder mechanics and instability.

3. Long Head of the Biceps Tendon: This tendon aids in stabilizing the humeral head within the glenoid cavity, especially during overhead movements. It works synergistically with the rotator cuff muscles, providing additional support during activities that place high demands on the shoulder.

4. Deltoid Muscle: While primarily a mover of the shoulder, the deltoid muscle also contributes to dynamic stability. It interacts with the rotator cuff muscles, helping maintain a balance of forces around the joint during movement.

5. Neuromuscular Control: Proprioception and reflexes are vital for dynamic stability. The central nervous system continuously monitors joint position and adjusts muscle activity in response to changes in force, direction, and joint positioning. This feedback loop ensures that the humeral head stays centered in the glenoid during rapid or complex movements.

6. Joint Capsule and Ligaments: Although passive stabilizers, the joint capsule and ligaments, including the glenohumeral ligaments, interact with muscles to enhance stability, especially at the extremes of motion. They help limit excessive motion when combined with dynamic forces.

The role of dynamic stability is particularly significant in everyday activities that involve overhead or repetitive arm movements. Key activities that depend on glenohumeral joint stability include reaching overhead (e.g., placing items on a shelf), lifting objects (e.g., carrying groceries or children), pushing and pulling (e.g., opening doors, pushing carts), throwing and catching (in sports), and performing fine motor tasks (e.g., writing or grooming).

Without adequate dynamic stability, individuals may experience shoulder dysfunction, pain, or injury during these activities, making daily tasks challenging and potentially leading to long-term complications. Understanding and maintaining dynamic stability in the glenohumeral joint is essential for overall shoulder health and function.

Radhika Saini & Khusbhu Saini
BPT 2nd year

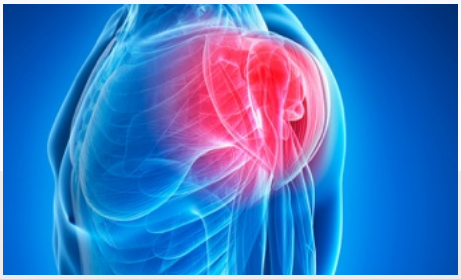
COMMON PROBLEMS RELATED TO DYNAMIC STABILITY IN THE GH JOINT

Shoulder Instability

Shoulder Instability:
Traumatic instability (dislocations) can occur due to falls or accidents, particularly if the shoulder is forced into an extreme range of motion.
Chronic instability often develops in individuals with weak or imbalanced muscles, resulting in the humeral head moving excessively in the joint.
Rotator Cuff Tears:
Weakness or injury to the rotator cuff muscles can lead to instability, pain, and difficulty in performing overhead tasks.
Impingement Syndrome:
This occurs when the rotator cuff tendons are compressed during shoulder movements, often due to poor dynamic stability. It can lead to inflammation and reduced function.

Contemporary Home

How to Improve GH Joint Stability: Improving dynamic stability in the GH joint requires a comprehensive approach targeting muscle strength, proprioception, and flexibility. Key strategies include:
Strengthening the Rotator Cuff: Exercises like external rotations, internal rotations, and scaption (lifting the arm in a scapular plane) help to build strength in the rotator cuff muscles, enhancing their ability to stabilize the joint.
Scapular Stabilization:
Strengthening scapular stabilizers like the serratus anterior and trapezius is crucial. Exercises like scapular retractions, wall slides, and push-ups plus can improve scapular positioning and function.



Proprioception and Neuromuscular Control

Training joint proprioception through balance exercises or closed-chain movements (e.g., plank variations or using stability balls) helps improve the body's awareness of joint position, enhancing dynamic control.
Flexibility and Mobility: Maintaining adequate flexibility in the shoulder muscles and joint capsule can prevent stiffness that might hinder dynamic stability. Stretching the pectoralis muscles, latissimus dorsi, and posterior shoulder is essential.
Functional Movement Training: Engaging in movements that simulate daily activities or sports, while focusing on proper form, can enhance stability in real-life scenarios. These can include overhead movements with resistance or weighted carries.

Parkinson's Diseases

Manisha Chaudhary BPT 3rd year

Parkinson's Disease (PD) is a progressive neurodegenerative disorder that primarily affects movement. It is the second most common neurodegenerative disorder after Alzheimer’s disease and typically occurs in people over the age of 60. Parkinson's disease is characterized by the gradual loss of dopamine-producing neurons in a region of the brain known as the substantia nigra, which is part of the basal ganglia, a network responsible for coordinating smooth and controlled movements.

Key Features of Parkinson's Disease

1. Motor Symptoms (also known as Parkinsonism):

Bradykinesia: Slowness of movement, a hallmark feature of Parkinson’s. It affects activities like walking, eating, writing, and buttoning clothes.

Tremor at Rest: A rhythmic shaking, usually starting in one hand (a "pill-rolling" tremor) and often more noticeable when the hand is at rest. It can also affect the legs, lips, or jaw.

Muscle Rigidity: Stiffness and inflexibility in the limbs and trunk, leading to muscle pain and a reduction in the range of motion.

Postural Instability: Difficulty maintaining balance, which often leads to falls in the later stages of the disease.

Gait Disturbances: A characteristic shuffling walk with short steps, reduced arm swing, and difficulty initiating movement (freezing).2. Non-Motor Symptoms: Non-motor symptoms can significantly affect the quality of life and sometimes precede motor symptoms.

They Include

Cognitive decline and dementia: Memory problems, difficulty concentrating, and in later stages, Parkinson's disease dementia (PDD).

Mood disorders: Depression, anxiety, and apathy.

Sleep disturbances: Including insomnia, REM sleep behavior disorder (acting out dreams), and excessive daytime sleepiness.

Autonomic dysfunction: Problems with blood pressure regulation, constipation, urinary issues, and sexual dysfunction.

Loss of sense of smell (anosmia): This can appear years before motor symptoms begin.

Pathophysiology

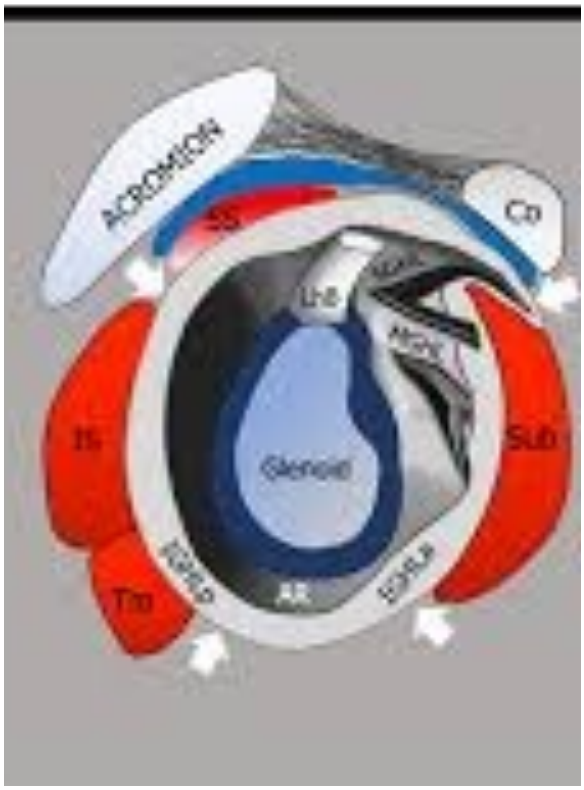
The hallmark of Parkinson's disease is the loss of dopamine-producing neurons in the substantia nigra. Dopamine is a neurotransmitter essential for regulating movement and coordination. As these neurons degenerate, dopamine levels drop, leading to impaired signaling in the brain’s motor circuits, particularly the basal ganglia. This disruption causes the characteristic motor symptoms of Parkinson's.

Causes and Risk Factors

The exact cause of Parkinson's disease is unknown, but a combination of genetic and environmental factors is thought to contribute to its development. Key factors include:

1. Genetic Factors
2. Environmental Factors
3. Age
4. Gender
5. Lifestyle Factors

BIOMECHANICAL CHANGES AT SHOULDER GRIDLE ADHESIVE CAPSULITIS OR FROZEN SHOULDER PATIENT



Exploring Adhesive Capsulitis: Biomechanical Changes and Their Impact on Shoulder Function and Rehabilitation."

MEGHA HARTIWAL, BPT 4TH YEAR

Adhesive capsulitis is a condition characterized by progressive stiffness, pain, and limited ROM in the shoulder due to the inflammation of the shoulder capsule.

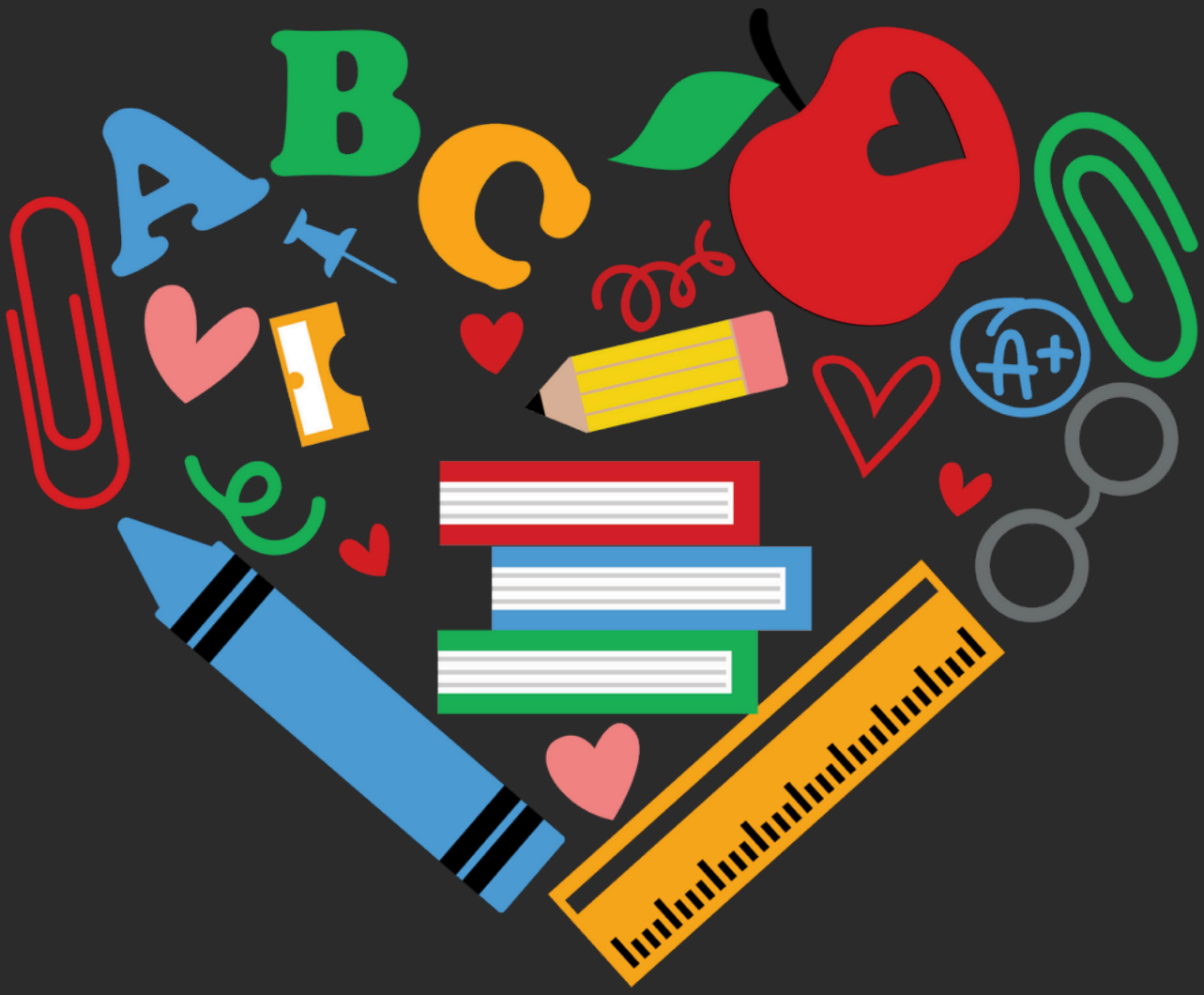
Patients typically experience a marked reduction in both active and passive range of motion, particularly in external rotation and abduction, due to the thickening and tightening of the shoulder capsule. This condition also leads to altered joint mechanics, resulting in increased stress on surrounding structures, which can exacerbate pain and limit movement.

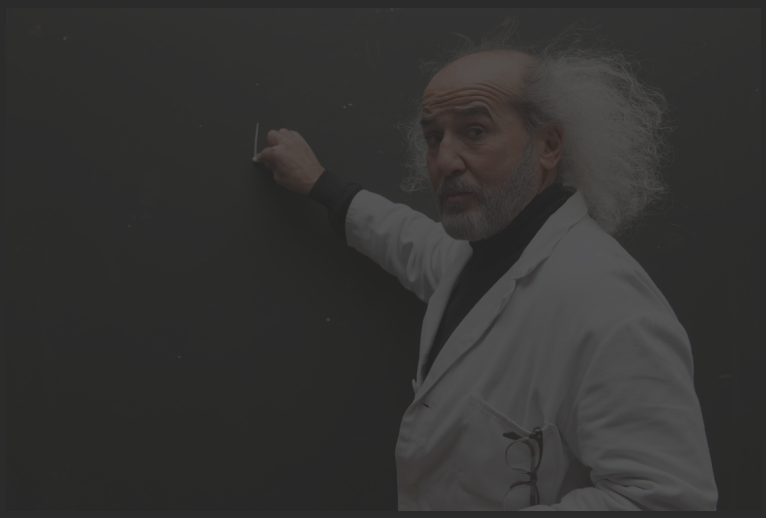
there is often a noticeable muscle imbalance, with weakness in the rotator cuff and other shoulder stabilizers contributing to instability and further mobility limitations. The joint capsule itself becomes fibrotic and inflamed, increasing tension and restricting the gliding movements necessary for normal shoulder function.

Protraction/retraction movements are also altered less scapular protraction is present in the patient of frozen shoulder during arm elevation in frontal plane .

Altered SHR may cause abnormal movements of GH joint and this can lead to adhesive capsulitis.

Compensatory movements in the scapula may develop due to pain and stiffness, affecting overall shoulder mechanics and leading to suboptimal movement patterns. Finally, altered proprioception may occur, resulting in difficulties with joint position sense and coordination during movements. These combined biomechanical changes underscore the importance of a targeted physiotherapy approach to restore normal function and mobility in patients with frozen shoulder.





FACULTIES CORNER

Rethinking Ankle Proprioception: Are We Missing the Mark with Unstable Surface Exercises?

Ankle injuries, particularly lateral ankle sprains (LAS), are common, especially in sports. With recurrence rates exceeding 70%, the rehabilitation focus often shifts to improving proprioception—our body's ability to sense and control movement—around the ankle. Traditionally, balancing exercises on unstable surfaces, such as wobble boards or foam pads, have been the go-to for targeting ankle proprioception. However, emerging research is challenging this long-held belief.

Understanding Proprioception and LAS Recurrent

LAS recurrence is frequently attributed to a loss of proprioceptive function. The theory suggests that, after injury, the body struggles to accurately detect movements and joint position, leading to functional instability and increased risk of re-injury. Rehabilitation programs have, for years, incorporated exercises on unstable surfaces to stimulate the muscles surrounding the ankle, aiming to restore proprioception and improve stability.

But is this approach as effective as we think?

The Study: Shifting the Focus from Ankles

A laboratory study conducted by researchers including Henri Kiers and Simon Brumagne tested whether unstable surface exercises truly target ankle proprioception. They asked 100 healthy adults to stand barefoot on both solid surfaces and foam pads while applying mechanical vibration to stimulate proprioceptive signals. The key finding? Standing on foam or unstable surfaces does not significantly engage ankle proprioception. Instead, the body shifts its reliance away from the ankle, focusing on more proximal regions, such as the lower back and hips, to maintain balance. This finding has important implications for rehabilitation. It suggests that exercises on unstable surfaces might not directly improve ankle proprioception. Rather, they seem to challenge the central nervous system's ability to balance proprioceptive signals from multiple sources—hip, trunk, and vestibular input.

What Does This Mean for Rehabilitation?

If proprioceptive exercises on unstable surfaces are not targeting ankle proprioception as intended, it begs the question: How can we better tailor rehabilitation programs for athletes and individuals with recurrent LAS? The study points to two key areas for future exploration:

1. Targeted Proprioceptive Exercises: Clinicians may need to design exercises that specifically engage the ankle's proprioceptive abilities. This might involve more precise exercises that focus on joint position sense without relying on unstable surfaces.
2. Holistic Balance Training: Given that unstable surfaces do stimulate other body regions like the hips and trunk, these exercises might still be valuable but should be recognized for enhancing overall balance control rather than ankle-specific proprioception.

The Path Forward

This research opens the door to rethinking ankle rehabilitation strategies. While exercises on foam and wobble boards have their place in improving overall balance, clinicians should consider incorporating exercises that more directly engage the ankle's proprioceptive capabilities. This shift could lead to more effective programs, reducing the high recurrence rates of ankle sprains. In conclusion, the belief that unstable surface exercises are the best route to improved ankle proprioception might be outdated. By refining our approach, we can help athletes and individuals regain full function and reduce their risk of future injury.

BIOMECHANICS AND INJURY PREVENTION: A NARRATIVE REVIEW FOR PHYSIOTHERAPISTS

DR MADHU TEOTIA

Biomechanics in Physiotherapy

Biomechanics, the science of movement, has become an indispensable tool in modern physiotherapy, particularly in the realm of injury prevention.

Whether it's in sports, rehabilitation, or everyday activities, understanding how forces act on the body helps physiotherapists identify potential risks and develop strategies to avoid them.

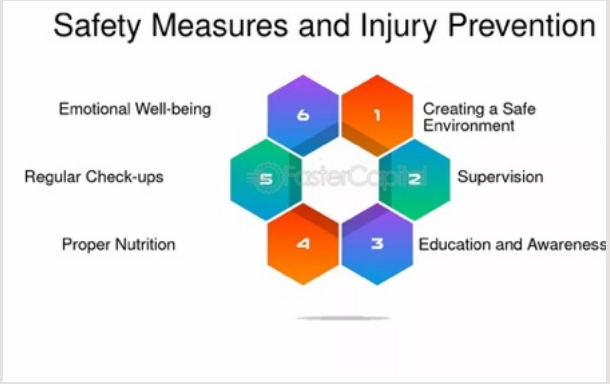
The Role of Biomechanics in Injury Mechanism

At its core, biomechanics examines how muscles, joints, and bones interact during movement. By analyzing these interactions, physiotherapists can identify dysfunctional movement patterns that contribute to injuries. For instance, poor running mechanics, such as excessive pronation or overstriding, can lead to stress on the knees and hips, increasing the risk of chronic injuries like patellar tendinopathy or iliotibial band syndrome.

Biomechanical assessments can be particularly valuable for athletes, helping them refine their technique and improve performance without overloading the body. Even in non-athletic populations, biomechanical analysis aids in recognizing compensatory movements that might lead to overuse injuries, postural problems, or joint degeneration over time. Preventing Injuries Through Biomechanical Insights

One of the most effective ways to prevent injuries is through early identification of risk factors. Biomechanics allows physiotherapists to:

- Detect Movement Asymmetries: Subtle imbalances in muscle strength, flexibility, or joint mobility can predispose individuals to injury. By identifying these asymmetries, therapists can intervene early, introducing corrective exercises and therapies to restore balance.
- Optimize Movement Efficiency: By improving movement efficiency, the body can distribute forces more evenly across joints and muscles, reducing the strain on any one area. For example, optimizing running gait reduces repetitive stress on the lower extremities, decreasing the likelihood of shin splints or Achilles tendinitis.
- Develop Injury-Specific Prevention Programs: Based on biomechanical assessments, therapists can design customized training programs that strengthen weak areas, improve flexibility, and correct movement deficiencies, thereby reducing injury risk.



Application in Sports and Clinical Settings

In the sports world, biomechanics has revolutionized injury prevention strategies. Many professional teams now rely on biomechanical data to monitor athletes' performance and predict injury risks. For example, tennis players with improper shoulder mechanics may be more prone to rotator cuff injuries, while soccer players with poor landing techniques may be at higher risk of ACL tears. In clinical settings, biomechanics helps in understanding how chronic conditions like arthritis or lower back pain develop. By assessing a patient's gait, posture, or functional movements, physiotherapists can uncover contributing factors and design interventions that address the root cause of pain or dysfunction.

UNDER THE SCOPE

DR NEHA VYAS

EXPLORING HIPPOTHERAPY WITH THE JOCKEY MOTION MASTER: A NEW FRONTIER IN REHABILITATION

Hippotherapy, or equine-assisted therapy, has long been a valuable method for improving physical, emotional, and cognitive functions. Traditionally, the rhythmic movement of a horse helps individuals with neurological and physical challenges to improve their posture, balance, and muscle coordination. But now, with the integration of advanced technology like the Jockey Motion Master device, the therapeutic impact of hippotherapy is being taken to new heights.

JOCKEY MOTION TRACKER

it is a sophisticated motion tracking device that simulates the horse's movement, allowing therapists to assess and monitor balance and posture during therapy sessions. This innovation offers a unique way to provide the benefits of hippotherapy in a controlled environment, ensuring precision and safety.

A NEW FRONTIER

- Continuous Monitoring: With real-time feedback, therapists can track patient progress more effectively and make instant adjustments to improve outcomes.
- Consistency: The Jockey Motion Master ensures uniformity in movement, which helps patients who may not have regular access to horses.
- Accessibility: This device makes hippotherapy more accessible, especially in urban areas where horseback therapy may not be readily available.

Integrating the Jockey Motion Master into hippotherapy not only enhances the therapeutic experience but also opens doors for further research in rehabilitation strategies. This blend of tradition and technology holds promise for improving patient care across various conditions, from neurological disorders to balance impairments.

MASTERMIND ARENA

BIOMECHANICS AND DIFFERENT PLAYING SURFACES

DR DEEPAK SHARMA

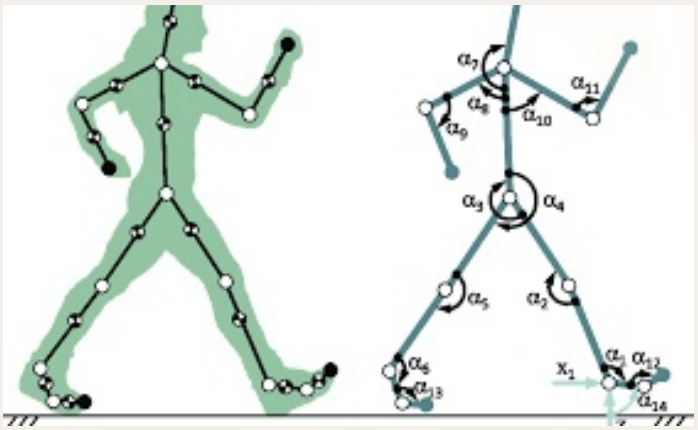
The study of biomechanics looks at the forces operating on the body and the movements they cause. Comprehending biomechanics is essential for assessing the efficacy, safety, and efficiency of an athlete's motions in sports. Variations in playing surfaces cause changes in the way the body interacts with the ground, which can result in adjustments to joint angles, force production, muscle activation, and stride length.

For instance, a soft surface like grass reduces impact forces but necessitates coordination and balance changes. Harder surfaces, such as hardwood or synthetic turf, on the other hand, encourage quicker motions but produce greater impact forces. To maintain peak performance, the human body must constantly adjust to these biomechanical difficulties.

Let’s explore how different playing surfaces shape an athlete’s performance

Grass Surfaces

When it comes to biomechanical stress, most people agree that natural grass is among the most accommodating surfaces. Because grass is soft, it absorbs impact forces better, which lessens the strain on weight-bearing joints like the lower back, hips, and knees. In high-impact sports like football, rugby, or soccer, where players frequently make contact with the ground, this attribute is especially helpful. Grass's cushioning properties can help lower the risk of overuse injuries, particularly in the lower limbs.



However, grass surfaces can be uneven and slippery when wet, so athletes will need to adjust their foot placement and balance. Athletes with uneven traction must continually realign their bodies and stabilize their joints to avoid slipping or falling. Increased activation of the stabilizing muscles surrounding the ankle and knee is a common biomechanical adaptation to grass, which lowers the risk of acute injuries like ligament tears as well as sprains of the ankle

Synthetic Lawn

The use of synthetic turf has increased as a reliable and low-maintenance substitute for real grass. On athletes, though, its biomechanical effects are very different. Consistent traction from synthetic turf enables faster acceleration and more accurate direction changes. Because of its consistency, synthetic turf is perfect for fast-paced sports like American football as well as soccer which call for agility.

The primary biomechanical obstacle associated with synthetic turf is its elevated level of friction. Better grip is achieved by greater friction between the athlete's footwear and the surface, but this higher friction also places more mechanical strain on joints during quick motions. This is particularly true for the ankle and knee, which experienced increased shear and torsional forces during pivots and sharp turns. Because of these increased forces, studies have indicated that synthetic turf may be linked to an increased risk of anterior cruciate ligament (ACL) injuries. To reduce their risk of injury, athletes must adjust by strengthening their neuromuscular control and joint stability.

DR DEEPAK SHARMA

Hardwood Surfaces

Mostly, indoor sports like volleyball and basketball are played on hardwood floors. Athletes can execute fast sprints, precise cuts, and high jumps because these surfaces are rigid and absorb little energy. Activities requiring quick force production, like running and jumping, benefit from the surface's firmness, which improves biomechanical efficiency.

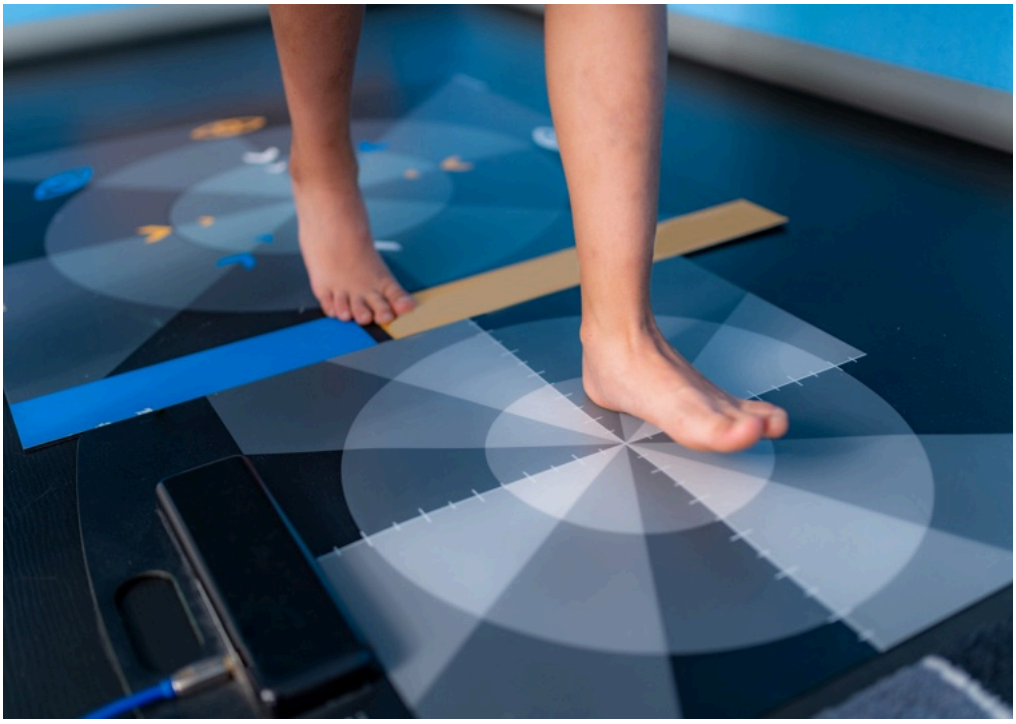
On hardwood floors, however, there is less shock absorption, which puts more strain on the athlete's musculoskeletal system—particularly in the lower extremities. Overuse injuries like shin splints, stress fractures, and patellar tendinitis can result from the high-impact forces that are transmitted through the feet, ankles, knees, and hips. Focusing on muscle strength, especially in the quadriceps and calf muscles, which are essential for absorbing impact forces during landing and sprinting, athletes can adjust to the biomechanical demands of hardwood

Preventing Injury via Biomechanical Examination

To create strategies that effectively prevent injuries, it is imperative to comprehend the biomechanical demands of various playing surfaces. Sports physiotherapists and coaches can utilize biomechanical analysis to pinpoint high-risk movements and customize training regimens to increase neuromuscular control, strengthen muscles, and stabilize joints.

For instance, to lower their risk of ACL injuries, athletes may benefit from exercises that focus on knee and ankle stabilization when playing on synthetic turf. Athletes can avoid falls and slips on grass by using balance training to help them adjust to the uneven surface. On hardwood floors, athletes should concentrate on plyometric workouts to strengthen their lower limbs and absorb the high-impact forces produced by jumping and running.

THE ESSENCE OF BIOMECHANICS: DECODING THE SCIENCE OF HUMAN MOTION



The Essence of Biomechanics: Decoding the Science of Human Motion

The study of mechanical concepts as they relate to biological systems, especially human movement, is known as biomechanics. The word comes from the words "bio," which means life, and "mechanics," which describes the laws of motion and force. It includes an examination of the internal (muscle activation) and exterior (gravity and friction) forces that affect motion. Biomechanics is an interdisciplinary science that combines anatomy, physiology, and engineering principles, despite having its roots in classical mechanics and biological subtleties.

The study of how the musculoskeletal system—which consists of the bones, muscles, ligaments, and tendons—interacts with these forces to produce movement is at the heart of biomechanics. Through investigation of this relationship, scientists and medical professionals can enhance comprehension of movement impairments, maximize efficiency, avert accidents, and create efficient recuperation plans.

Kinematics: This area of mechanics focuses on describing motion without taking into account the forces that propel it. In order to characterize movement in terms of joint angles, segmental rotations, and body position, kinematic analysis focuses on factors like displacement, velocity, and acceleration.

Kinetics: In contrast, kinetics studies the forces that cause motion. These forces consist of external loads such as ground reaction forces, joint torques, and muscle contractions. Understanding how forces are generated, absorbed, and transmitted through the body during actions like walking, running, or lifting requires a solid understanding of kinetic analysis.

Applications of Biomechanics

In several fields, such as sports science, rehabilitation, and ergonomics, biomechanics is essential. Its real-world uses include enhancing sports performance, enhancing workplace security, and supporting therapeutic rehabilitation. The following are some important domains where biomechanics is used:

1.Sports Performance and Optimization

Biomechanics is essential to improving performance and lowering injury risks in professional sports. Researchers can help athletes improve their performance by assisting them in identifying inefficiencies in their technique through the analysis of movement patterns. For instance, sprinters can improve their stride length, frequency, and ground contact time by using biomechanical analysis of their stride. In a similar vein, swimmers can modify their stroke pattern to reduce drag and increase propulsion.

Dr Mukesh Sharma

Injury Prevention and Rehabilitation

Preventing injuries and promoting healing are two of biomechanics' main goals in therapeutic environments. Knowing the mechanics of movement makes it possible to spot potentially dangerous patterns that could put someone at risk for harm. Gait analysis, for example, might identify variations in running or walking patterns that put more strain on particular joints and may result in overuse problems.

Targeted therapies in rehabilitation are developed based on the results of biomechanical examinations. Physiotherapists use biomechanical concepts to ensure that normal movement patterns are restored after an injury, such as a fracture or rupture of the ligaments, and to reduce the risk of re-injury. Wearable sensors are frequently used in advanced rehabilitation procedures to provide biomechanical input, which helps patients and therapists track progress and modify treatments as necessary.

Ergonomics and Workplace Health

Biomechanics, the science of creating workspaces and instruments that are tailored to employees' talents and limits, is crucial to occupational health. Musculoskeletal conditions including tendinitis, carpal tunnel syndrome, and lower back discomfort can be brought on by poor ergonomic design, especially in occupations that require repeated motions or extended postures.

Workplaces can be adjusted to lessen physical strain on employees' bodies, improving safety and productivity, by implementing biomechanical concepts. The frequency of work-related injuries can be considerably decreased, for instance, by promoting safe lifting practices, utilizing ergonomic equipment, and modifying workstation heights. Furthermore, especially in physically demanding industries, biomechanical assessments are frequently used to restructure activities and workflows to fit the needs of individual workers.

Future Directions in Biomechanics

Biomechanics is undergoing a transformation due to wearable technology, which allows real-time movement monitoring. Smart clothes with sensors offer biomechanical feedback, helping athletes and workers improve their techniques. Wearable medical technology is aiding injury rehabilitation by monitoring patients' progress and providing information on muscle activity, joint angles, and force distribution. Exoskeletons and prostheses with biomechanical optimization are also being developed, mimicking human limbs for natural movement patterns. Exoskeletons are being used in industrial labor and military settings, enabling users to lift large objects with minimal effort.

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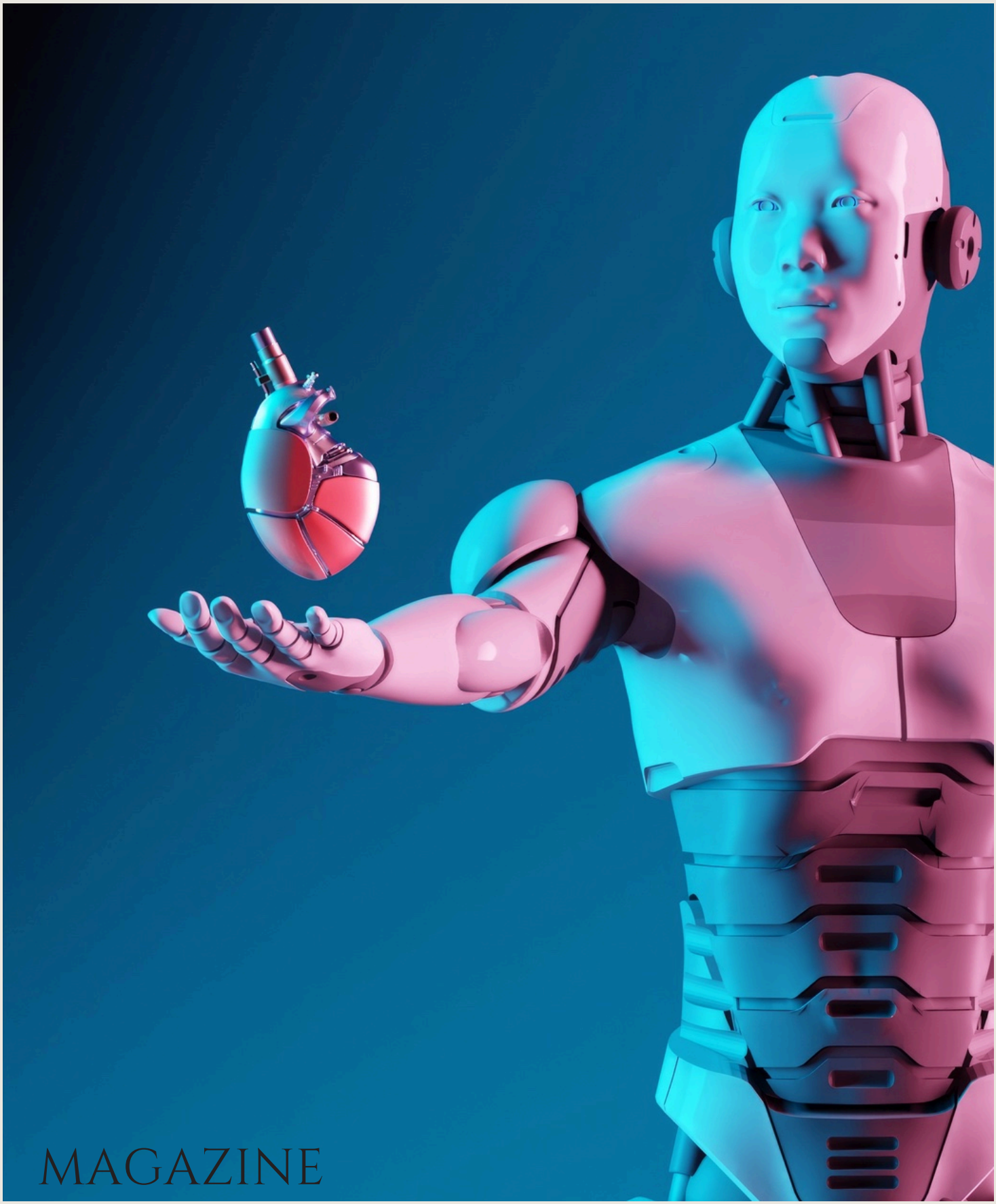

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