

Joint Structure and Function

There are three types of equine joints: synovial, fibrous, and cartilaginous

Overview

A joint is defined as an anatomic union or junction between two or more bones. There are three basic types of joints in the horse:

A fibrous joint. This is an immovable joint that exists between two bones, such as the bones of the skull;

A cartilaginous joint. This holds bones together via fibrocartilaginous discs and ligaments that permit only a limited amount of movement. Examples include the joints between individual vertebrae and the pubic symphysis (where the pubic bones join at the pelvic girdle); and

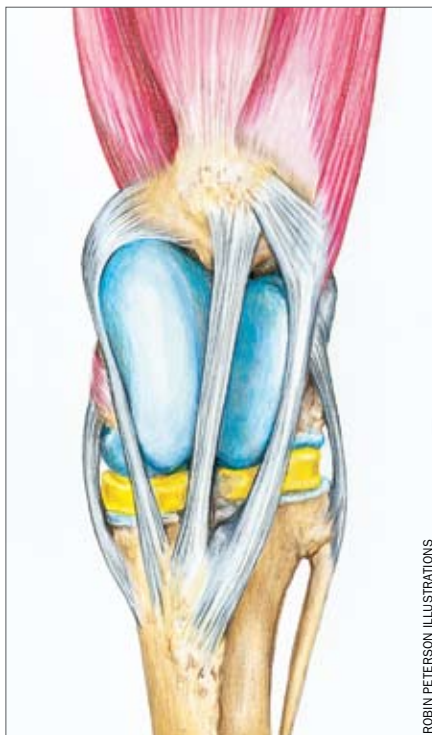
A synovial or diarthroidal joint. This is a freely movable anatomic structure.

Synovial joints are the most common type of joint in the horse's body. The main anatomic feature that distinguishes a synovial joint from a fibrous or cartilaginous joint is the presence of a joint capsule surrounding the joint and the existence of synovial fluid that lubricates the joint.

Structure of a Synovial Joint

A synovial joint exists where two or more bones lined with articular cartilage meet. The space between the two articulating bones is called the joint cavity, which is filled with synovial fluid. The synovial fluid is (primarily) synthesized by the synovial membrane (the inner lining of the joint capsule). The capsule and associated ligaments function to reinforce the joint, and together these structures essentially hold the joint together. Depending on the joint, discs of cartilage (called menisci) that function as cushions between the bones in a joint, and intra-articular ligaments (such as the cruciate ligaments in a horse's stifle), might also exist in a synovial joint. Outside the joint there are a variable number of ligaments and tendons that help stabilize the joint, such as collateral ligaments.

There are a number of different types of



ROBIN PETERSON ILLUSTRATIONS

The stifle is a type of hinge joint with rounded surfaces that allow quite a bit of rotational motion between the femoral condyles and the tibial plateau. Meniscal cartilages act as stabilizers.

synovial joints in the horse. The most important of these are a ball and socket joint in which the rounded end of one bone fits into the hollow curve of the opposing bone, such as the hip and shoulder; a hinge joint in which the bones and ligaments are arranged to permit motion in one direction only, such as the elbow, and a gliding joint, such as the carpus (knee) and tarsus (hock), in which the flat surfaces of opposing bones slide over one another permitting only a limited amount of movement.

Synovial Joint Function

The two primary functions of a synovial joint are to permit movement and transfer load between bones. In a normally functioning joint, both of these tasks are achieved in an efficient and pain-free

manner. The secret of how this frictionless, painless movement occurs lies primarily in the structure and function of the articular cartilage lining the ends of opposing bones.

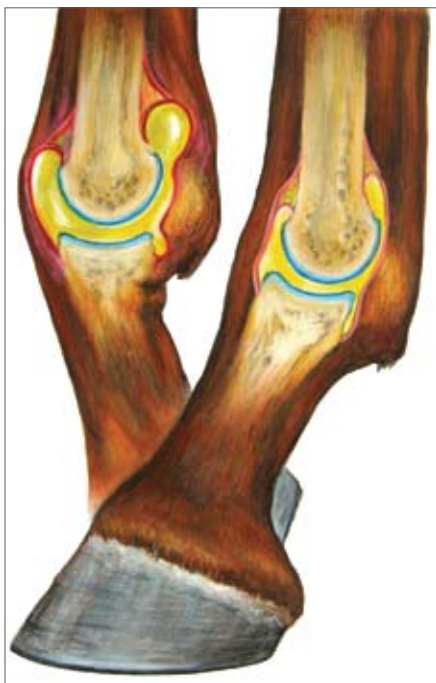
Articular Cartilage

At the ends of the bones in a synovial joint exists a thin layer of articular cartilage. This tissue is extremely specialized to withstand the very high loads that occur during physical activity. The articular cartilage is composed largely of water (70-80% of articular cartilage is water), type II collagen fibrils, proteoglycan molecules such as aggrecan, chondrocytes (cartilage cells), and a variety of miscellaneous (yet important) molecules.

The chondrocytes are responsible for synthesizing, organizing, and regulating the extracellular matrix of the articular cartilage. The extracellular matrix is the tissue surrounding the chondrocytes where water, collagen, and proteoglycans are found. The type II collagen forms a fibrillar network within the extracellular matrix, which is responsible for maintaining the shape and strength of the tissue.

Also found within the extracellular matrix are large, negatively charged macromolecules called proteoglycans. These are a mixture of proteins and long chains of sugar that attract large amounts of water, but repel each other. The most common proteoglycan in articular cartilage is aggrecan—a very large proteoglycan that plays a pivotal role in the function of articular cartilage.

During weight bearing, the aggrecan molecules, which are already very tightly packed together, become even further compressed. During this compression, water molecules (that were attracted to the negatively charged aggrecan molecules) are forced from the extracellular matrix of the cartilage and all of the negatively charged branches of the aggrecan



View of normal left fetlock joint and abnormal (inflamed) right fetlock joint.

molecule repel each other like similar ends of a magnet. As a result, the ends of the bones are protected by this layer of

shock-absorbing articular cartilage and the load is transmitted between the opposing bones.

Of course, a multitude of additional factors also plays a role in movement, such as the production of viscous, lubricating hyaluronic acid by the synovial membrane; however, the structure and function of articular cartilage are certainly key elements to ensuring the proper function of a synovial joint.

When Things Go Wrong: Osteoarthritis

In situations where the chondrocytes are unable to maintain a healthy, fully functional extracellular matrix, problems ensue. Osteoarthritis, defined as the erosion of articular cartilage, is one such example of what can go wrong in a joint. In horses with osteoarthritis, the balance between the degradation and synthesis of the extracellular matrix is disrupted favoring the destruction of the tissue. Osteoarthritis is a major cause of lameness in athletic horses and can be painful debilitating condition that might be career-ending or even life-threatening. 🐾

FAST FACTS

- **Synovial joints** are highly movable joints that function to permit movement and transfer load between bones.
- **Synovial joints** are made of two or more bones covered with a layer of articular cartilage. A joint capsule connects the bones and creates a cavity, which is filled with synovial fluid.
- **Movement and load transfer** is achieved in a frictionless and pain-free manner in a normally functioning joint.
- To achieve this, the articular cartilage located at the ends of the connecting bones must function normally.
- **In joints with inflammation**—such as an infected joint or a joint with osteoarthritis—the articular cartilage is damaged and movement is no longer as efficient or pain-free as it should be.

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