THE HINDLIMB JOINTS AT THE BROWN BEAR

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Abstract: The passing from the patrupedal moving to the biped station determines the hindlimb joints solicitation on the corporal weigh and muscular activity actions. Consequently, the modifications of the articular structures that are produced, determine the moving in good conditions. So, at the sacro-iliac joint level, facies auricularis is extended to all sacral vertebras and to the whole dorsal half of the ilium palette, it being strengthened by short and strong fascicles that consolidate them as a whole. In addition to that, two-three ilio-lumbaris fascicle double the ventral sacro-iliac ligament. The ligamentar acetabular fosse displacement facilitates the prancing and the biped position through the displacing of the weigh center towards the median plan. In flexion, the medial tibial rotation is produced by the caudal sliding of the lateral menisci. The plantigrad station determines the thickness and impregnating with cartilage that leads to from the transformation of the tarso-metatarsian joint into an articular complex with a reduced mobility. The missing of the collateral ligaments, an aspect in correlation with the aspect of the navicular distal articular surface, determines the foot deviation towards the interior. The lateral moving is limited by the calcanean articular surfaces.

INTRODUCTION

The brown bear (Ursus arctos) is a plantigrad animal with a predominantly patrupedal movement. The passing from the patruped to the biped station determines the supplementary solicitation of the hindlegs joints both by the muscles activity and because they support the whole weight.

MATERIAL AND METHODS

The study was made on two bears killed by hunting. The articulations of the pelvic leg were processed through the classic anatomical methods that include the dissection, the identification and preparation of the articular structures and drying and airing preservation. After the dissections, for exemplifying and interpretation, the results were photographed.

RESULTS AND DISCUTIONS:

The brown bear presents, as the human being, the plantigrad support. On the other hand it moves the body with the same easiness both in the patruped and biped station (1, 8). Consequently, by bears, the pelvic joint with the spine is extremely solicited, the coxo-sacral articular surfaces are extended to the whole dorsal half of the ilium palette and on all the sacrale vertebras. The articulation is consolidated by the intraarticular ligaments and the dorsal and ventral sacroiliac ligaments which are extremely short and very strong and at the same time united with the same periostal fibres (fig. 1, A, B) (7, 8). To the bear, one can see a bunch formed by two-three ventral ilio-lumbar fascicles with insertion between the ilium palette and the transversus process of the last lumbar vertebras (fig. 1, B). The sacro-tuberos ligament is represented by a strong and thick band that, together with its opposite, coordinate the prancing muscles force (fig 1-A).
The hip joint is particularized by a large mobility, but limited by the muscular mass (2). The articular capsule is inserted to the base of the femoral head articular circumference (fig. 2-A, B). The articular surface of the acetabular cavity is more excavated being interrupted in its centre by a ligamentar fosse that is large and oriented towards to the medial. In the biped station the body weight is moved towards the central axis, in this way being better sustained by the inferior legs.

The femoral head has a hemicylindrical articular surface, having a ligamentar fosse with a circle aspect. The round ligament is conical in shape, 1 cm length, aspect that allows the ample abduction and rotation moving of the leg (fig. 1-A). At the same time, the conic disposition of the round ligament determines the pressure produced through a muscle action on each segment to the cavity to be uniformly supported by whole articulatory complex, especially when moving the body up and down in biped station.

![Fig. 1. The sacro-iliac joint at brown bear A- dorsal view, B- ventral view](image)

**Fig. 1. The sacro-iliac joint at brown bear A- dorsal view, B- ventral view**

1, 1’- ala ossis ilii, 2- tuber ischiaticum, 3- os pubis, 4- femur, 5- sacrum, dorsal view, 5’- sacrum, ventral view, 6- ligg. sacroiliaca dorsalia, 7- lig. sacrotuberale, 8- capsula articularis articulatio coxae, 9- m. capsularis, 10- ligg. sacro-iliaca ventralia, 11- ligg iliolumbaris, L- vertebrae lumbales

The femuro-tibial joint (the principal part of the knee joint), as to the rest of mammals, presents the main articular surfaces incongruent as an aspect (4, 5). The capsule is large.

Laterally and medially the well represented collateral ligaments are structured (1, 2). The medial collateral ligament, thicker than the other, is inserted to the ligamentar fosse of the medial condile of the femur and to the basis of the tibial medial condile. The lateral collateral ligament is represented by a more reduced ligament that is inserted on the ligamentar fosse of the lateral condil and proximal extremity of fibula (fig. 3-A, B).
The decussated ligaments are formed by the thicker fascicles. The anterior ligament has its origin on the tibial central ligamentary fossa and the insertion on the medial faces of the lateral femoral condyle. The caudal fascicle, thicker too, is inserted into the femoral intercondylar fossa and to the tibial caudal incisure (fig. 3- C).

The articular menisci have a half moon aspect and relatively thin and are united by a bunch of fibres. Caudally, as to the rest of mammals, the lateral meniscus has a double
insertion, menisco-tibial and menisco-femoral ligaments. The medial meniscus is anterior inscrued by the ligamentar tubercle of the posterior ligament and this is being placed to the other condile of the tibia. This long insertion limitates its moving. During the flexion, the lateral meniscus moves to the caudal zone, through its sliding on the rounded articular surface of the lateral condile of the tibia. Therefore, these aspects allow the tibial rotation around it axis in report of the femur (fig. 1- A). The articular surfaces of the femoral condiles are particularized through the disposition of the articular surfaces that are separated into two plans that are limited by a reduced articular crest: one plan for extension and the other for flexion. The femuro-patelar articulation is made between the femur trochlea and patellar cochlceea, as usual (2, 3). The throchlea appears as a large notch delimited by a reduced crests. The tibio-patelar ligament is represented by a thick fascicle inscrued on the cranial tuberosity of the tibia, about 2-3 cm upper by the articular circumference. The femoral condiles present the femoral sesamoids articular surfaces with about 1, 5-2cm, their articulations having a reduced but a strong capsule. Sometimes, only lateral presents is described, because the medial is as a fibro-cartilaginous condensation into the tendon (fig. 1).

The proximal tibio-fibular joint is represented by a plane articular surface both fibulary and tibialy. The large tibio-fibular space is completed to the 1/3 distal by an
incomplete and thin fibrous blade (3). The distal fibulo-tibial articulation is plane, obliquely oriented and its surface forms the lateral wall of the cochlea (fig. 4, 5, 6).

The tibio-tarso-metatarsien joint (the heel joint) has a large capsule that covers the whole articular complex. Dorsally it has two ligaments thickness that go from the talus dorsal ligament fosse to the fibula, cuboideum and first cuneiform, central bone and the ligament fascicles among the tarsian bones (1). From the collateral ligaments we remark the presence of the fibulo-calcaneen ligament situated laterally, the fibulo-astragalian ligament situated caudally and the calcaneo-naviculare ligament. The rest of bones are articulated through some short ligaments (fig. 5, 6). At the plantar level, a long and strong plantar ligament is present (1, 2). That goes from the caudal limit of the calcaneus to the fifth metatarsus. Into its thickness the sesamoid bone appears. Obliquely oriented, the profound ligaments go from sustentaculum tali to each metatarsus bone. The superficial fascicles, represented by the long plantar ligament and the interosseous tendons create together a fibro-cartilaginous plaque that strengthens the local region and offers the place for muscles insertion (fig. 5).

![Fig. 6. The lateral aspect of the heel joint at brown bear](image)

T-tibia, Fb-fibula, Tl-talus, C-calcaneus, Cb-os cuboideum, Mt-os metatarsalia, 1- membrana interossea cruris, 2-capsula articulare articulatio tali, 3-lig. calcaneo-fibularis, 4-lig. talocalcaneum dorsale, 5-lig. calcaneonavicularis dorsale, 6-lig. plantare longum, 7-tendo m. fibularis longus, 8-tendo m. extensor digitii lateralis,

The heel articular complex executes mainly flexion and extension from the tibio-astragalian. The missing of the collateral ligaments, correlated with the aspect as an articular head of the distal surface of the astragal, lead to the possibility of moving the foot medially (1, 8). The rest of the bones form together with the metatarsian bones a little mobile articular complex, determined by the plane or fragmented articular surfaces (fig. 4, 6).

The aspect of the distal articular surfaces of the last tarsian row, that is convex dorso-plantary, and the presence of the short tarso-metatarsian ligaments, shows a reduced possibility in moving. The articular consolidation is made by the joint capsule together with the lateral and medial collateral ligaments each of them represented by anterior and lateral short and strong fascicles (fig. 4, 5).

The sesamoid bones are articulated through the sesamo-phalanx and intersesamoidien ligaments (2, 3, 8). By studying the form of the articular surfaces we can observe that the
proximal phalanx are articulated dorsally with the head of each metatarsus and the sesamoid bones are plantarly articulated with the condyles of each metatarsus bones (fig 5).

CONCLUSIONS

- The sacro-iliac joint is consolidated by the intraarticular ligaments, as well as by the dorsal and ventral sacroiliac ligaments that are intersected with the periostal fibers and a bunch of two, three ventral iliolumbar fascicles that are inserted between the ilium plaque and the transverses process of the last lumbarum vertebra.
- In flexion, the lateral meniscus slides caudally on the rounded articular surface of the tibial lateral condyle, aspect that permits the tibial rotation in the femur rapport.
- The calcaneo-metatarsal ligaments are represented by the superficial and profound fibers the latter going from the sustentaculum tali to each metatarsus bones.
- The missing of the collateral ligaments of the heel joint correlated with the similar aspect to an articular head of the astragalian distal articular surface, lead to the possibility of the medial foot moving towards the medial plan.

BIBLIOGRAPHY