In Search of Illi's Ligament: Possible Evidence Found in Mammalian Sacroiliac Joints. The Enigma Continues

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ABSTRACT

Objective: A pilot anatomical study of quadruped sacroiliac joints was designed to examine the possibility of the existence of Illi's ligament in ovine and bovine specimens. It was aimed at investigating this enigmatic anatomical structure which is also called the superior intracapsular ligament of the sacroiliac joint.
Method: Ten ovine and 4 bovine sacroiliac joints underwent gross dissection and inspection. One ovine specimen was selected and sent to a veterinary laboratory for independent histologic examination. Photographic evidence was also obtained during the dissection.
Results: All but 1 ovine specimen revealed a rather prominent ligamentous structure at a predictable site within the sacroiliac joint. This structure was considered to be the sought-after superior intracapsular ligament of this articulation.
Conclusion: Independent analysis of the submitted specimen confirmed it as a ligamentous structure. This finding would tend to confirm Illi's original finding of a previously unheralded anatomical structure of the sacroiliac articulation. As a comparative measure, a cursory dissection of a kangaroo pelvis was also conducted.
Further sacroiliac articulations studies from other specimens, particularly primates and ratites, could be justified to clarify the perceived role of Illi's Ligament in this articulation's physiology.

Keywords: Anatomy; Ligament; Sacroiliac Joint [Chiropr J Australia 2016;44(1):52-72]

INTRODUCTION

This pilot study of quadruped sacroiliac joints was designed to examine the possibility of the existence of Illi's ligament[1] in mammals. As opposed to man's upright posture, we hypothesised that the varied postural stresses in quadruped sacroiliac joints may show Illi's ligament occurring at a greater or lesser rate to that shown in previous studies in humans by Freeman et al.[2] We hypothesised that if the structure was more clearly evident in quadrupeds, it could provide further insight as to the ligament's necessity and function in sacroiliac physiology.

Before beginning his search in human sacroiliac joints, Illi postulated the probability of such a ligament. He reasoned that the articulation required the particular restraint and additional strength that such a ligament would serve in *'directing and limiting sacroiliac movement'*.([1, pp 13)] Illi predicted that such a ligament should exist at the anterior-superior margin of the human sacroiliac joint.([1, pp 14)] Such an anatomical structure would provide additional vertical

tensile strength and stability of sacral movement at those joints, particularly in erect human posture. (Figure 1.)[3]

The possibility of no such ligament being found in the animals was also considered. However, it was felt that if it existed, a finding either way could help facilitate the understanding of this enigmatic structure.

We then hypothesised that the different pelvic mechanics and ligamentous stresses in quadruped sacroiliac posture might indicate a less consistent source of Illi's ligaments than that found in man. This proved *not* to be the case. In fact, the prevalence of the ligament was of a greater frequency that that found by Freeman et al in human sacroiliac joints.[2]

Illi did not locate the ligament using a conventional dissection technique on his first 2 specimens. However on the next 8 specimens, he entered the joint by removing osseous and cartilage tissue from a site parallel to the plane of the joint through the innominates. In this manner he readily accessed the ligament.[(1, pp 13)]

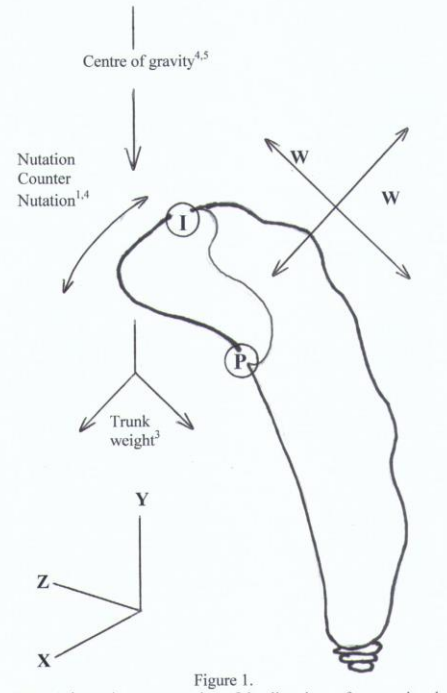


Figure 1.
"W" = Schematic representation of the directions of conventional primary ligamentous support of the sacroiliac joint. [After Weisl[3]]
"I" = site of Illi's ligament[1(pp 14)]
"P" = site of infero-anterior polar ligament [7]
Both *polar* ligaments were considered as assisting in the stabilisation of sacral nutation and counter nutation about X Axis, as well as lateral tilting of sacrum about the Z Axis.
Illi proposed that the sacrum underwent a gyroscopic motion within the pelvis during human gait. [1(pp 13),6] It is thought the *polar* ligaments would permit this movement.

One major structural difference of the quadruped pelvis was the unified or fused symphysis pubis. This normal characteristic leaves only the 2 intra-pelvic articulations, resulting in the sacrum articulating within the fused innominates. It then stands to reason that this must create quite varied pelvic mechanics to that of bipeds. It is speculated that these features may contribute to the rather stiff gait noticed with bovines in particular.

Illi's anatomical discovery has been confirmed in the medical literature.[7,8] Two French medical papers recognized Illi's discovery. They report becoming aware of this ligament through reading the first edition of Illi's 1949 book *Treating the back of the child that is preventing the rheumatism in adults.*[8]

In 1955 and 1957, Bonjean, Dejussieu and Bisch, and others[7,8] acknowledged Illi's ligament.[1,9-11] They then hypothesised and found yet another previously unidentified sacroiliac ligament. They named it the *infero-anterior polar ligament* at the caudal limit of the joint. (Figure 1) Although a cursory examination was made, this ligament was not differentiated in this current

study. As translated, Bonjean et al[7] make the following observations of their newly revealed ligament:-[6]
It passes from the '*periphery towards the auricular centre.'*

- It is a "*ligament of counter nutation.*" It is located at the opposite end of the sacroiliac joint to Illi's ligament.
- For the sacral part, its insertion is *"at the level of the anterior-inferior angle of the auricular sacral surface." and on the iliac part, it is at the level of the homologous surface corresponding to the iliac bone.'*
- The *"ligament is short (about 3-4mm long 2-2.5 mm thick), tough and strong. It is oblique from posterior to anterior, inferior to superior and from internal to external."*
- Bonjean et al state that as the fibres run *'oblique from posterior to anterior'* they are at '*a different direction'* to those identified as Illi's ligament.
- *"It is sub-capsulary"*

In relation to the infero-anterior polar ligaments[7,8], no such transcapsular ligament of this nature was identified in our current study.

Indeed, the nomenclature used in the various references is somewhat ambiguous. Illi's ligament has been identified as the *polar ligament*,[7,8] *intracapsular ligament*,[2] *subcapsular ligament*[4] as well as the *intra-articular ligament*[1] - a term used by Illi himself. [1 (pp 13)]

Recent detailed MRI studies of the sacroiliac joint also appear to contribute ambiguity by introducing new terminology. Hueft-Dorenbosch and colleagues report such findings in the sacroiliac joint as *retro-auricular ligaments* and *interosseous ligaments crossing juxta-auricular fatty tissue.*[12]. Another study by Weber et al[13] nominated a *dorso-superior ligamentous compartment* in the sacroiliac joint. The new terminology does not distinguish or acknowledge the ligament postulated and identified by Illi and others.[1,2,9,10]

A further detailed MRI study in 2014 by Egund and Jurik, introduced another ligamentous term - the *proximal transverse sacroiliac ligament* (PSIL). This is noted as being distinct from the ventral sacroiliac ligament. They do not identify a structure as subcapsular or Illi's ligament, but describe strong ligamentous fibres which insert into "*both the bone and in the iliac and sacral cartilage"* in the proximal third of the joint.[14]

A general Google search located a single reference to a *proximal sacroiliac ligament*,[15] identified as the PSIL by Egund et al.[14] It is equivocal as to whether this refers to Illi's ligament. A search of PubMed and Google Scholar did not locate any other references to the PSIL or PSL.

It is also thought that this study under MRI by the Danish Ankylosing Spondylitis Society (Figure 2) may also be informative on this matter.[15] Such a study would finally formalise the recognition of the presence of Illi's superior intracapsular ligament of the sacroiliac joint be accepted. Additional MRI slices may clarify radiological confirmation of the ligament.

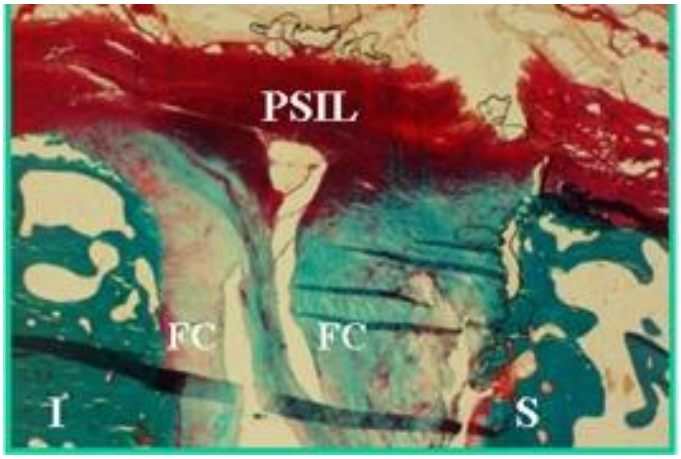


Figure 2. Histology section of the cranial aspect of the sacroiliac joint depicting the proximal transverse sacroiliac ligament (PSIL).[14,15]. [Fibrocartilage (FC)]

In recent times, it is not unusual for anatomical structures to be discovered, as this seems to be a regular occurrence. In 1969, Golub and Silverman named the variable *transforaminal ligament* of the lumbar spine.[16,17(pp 44-48,196)] Hack and colleagues published details of another previously unknown but particularly significant spinal feature to chiropractors. This 1995 finding comprised *a connective tissue bridge between the rectus capitus posterior minor and the spinal dura at the level of the atlanto-occipital junction*.[18] Just 10 years later, Dunn and colleagues observed the *sphenomandibularis muscle* at the occipital level, although it has since been claimed that this is an anatomical variant.[19] Also of particular interest to chiropractors was the discovery of the previously unknown *intracostal ligament* in 2010 by Matullo and colleagues. They noted that the ligament *"limits the potential space through which the T1 ventral ramus passes before joining the C8 ventral ramus."* [20]

Other previously unreported anatomical structures have evolved with the advent of the MRI. For instance, as recently as 2005, deAbreu et al identified a previously unreported ligament in the human knee - the antero-lateral ligament.[21] This anatomical discovery was presented earlier as a scientific paper at the 2005 conference of the Radiological Society of North America. The paper was presented on behalf of colleagues by Dr Michelle Wessely who is also a chiropractor. Although her contribution was noted by her presentation at the conference, Dr Wessely was not listed as a contributor in the published paper.[22]

As recently as 2015, it has only now been confirmed that a lymphatic system exists in the dura of the central nervous system.[23,24]

We examined comparative anatomy texts in relation to quadruped sacroiliac joints.[25-30] No evidence of a structure consistent with that designated as Illi's

ligament was found. However, the literature search did reveal unexpected references to interarticular villi between the articular cartilage surfaces.

A paper on canine sacroiliac joints by Gregory et al.[30] made no reference to any intracapsular sacroiliac ligament. They did however report on a *periarticular cranial* sacroiliac ligament. They also noted *"...a delicate fibrovascular proliferation, or pannus,* (which) *extended over the ventral portion of the (synovial) joint, in a six-year-old dog."* No mention was made of an inflammatory process or degenerative change involving this finding, so the proliferation would appear to have been a normal finding of an intra-articular nature.

Schunke records that in 1902, Retterer studied the sacroiliac joints of sheep, horses, rabbits and guinea pigs. No mention is made of an intracapsular ligament. He also cites Prentiss who noted *"a few fasciculii...connecting the two opposing surfaces"* in an infant's sacroiliac joint.[31]

In relation to infant sacroiliac joints, Schunke noted '*synovial villas'* and also cites a study by Pilatte and Vignes who noted that in infants, *"the articular surfaces are frequently united by fibrocartilage bands"*. Their 1919 study attributed these bands to *"retardation of the development of the articular cavity."* He noted that Brook did not find such bands and stated that they *"...must be an extremely rare condition."* [31]

The many villi may also be what Last refers to *"...as fibrous bands which pass from one articular surface to the other."* [32]

Bowen and Cassidy found that humans, in their seventh decade possessed *"...fibrous interconnections... ...linking the joint surfaces.*" suggesting they develop as part of an aging or degenerative process.[33]

Dihlmann stated that *"Movement (of the sacroiliacs) is inhibited by the interconnections of the articular surfaces. These interconnections are further reinforced by surface irregularities which, in the adult, may rise several millimetres beyond the level of the articular surfaces."* [34] Although Dihlmann does not detail these *interconnections*, it is assumed that he could be referring to villas similar to those mentioned by Schunke.

However, Schunke also found that embryologically, a septum was common *"...and persisted until sometime after birth."* One 5-month-old foetus *"...contained a thick, fibrous septum bridging the middle of the joint..."* Another 9 month old infant's sacroiliac revealed *"...connecting bands ...there was a thick, irregular, semi-fibrous bridge connecting the two surfaces."* [31]

In considering the importance of sacroiliac biomechanics particularly in racing animals, there appeared to be limited research into this articulation. Notable exceptions to this are the extensive studies by Dalin, Jeffcott and others who incidentally, also found *"fibrous interconnections linking the joint surfaces..." of the sacroiliac articulations.*[35-38]

METHOD

A total of 14 ovine (10) and bovine (4) sacroiliac articulations were investigated. In all except one instance, the pelvises were intact. In that case - the larger bovine sacroiliac articulations were obtained as separate specimens from the same pelvis. These specimens were obtained through a commercial butcher, in which occupation the bony pelvis is known colloquially as the "aitch-bone".[39]

The specimens consisted of 1 fresh juvenile bovine pelvis, 2 separate adult bovine hemipelvises, and 4 complete ovine pelvises. The elapsed time from slaughter to dissection was consistent in all specimens examined - some 2-3 days. One further mature ovine pelvis was obtained to compare a possible finding of Illi's ligament with younger specimens - no appreciable difference in that comparison was noted. The sex and approximate age of some of the specimens were advised by the supplier. (Table 1)

Approximate Age of Specimens

Bovine.#1	5 months	(Whole male pelvis) L - Location of ligament estimated and marked on iliac surface prior to exposing. R - Damaged joint tissue
Bovine #2	10-12 months	(2 separate male S/I's) Transversely bisected across middle region of sacroiliac joint prior to accessing joint space.
Ovine #1	4-8 months	(Whole male pelvis) L - Lateral approach through ilium. R - Medial approach through sacrum
Ovine #2	4-8 months	(Whole female pelvis) Extraneous pelvic bones removes at level of sciatic notch in order to access each joint space from caudal periphery.
Ovine #3	3-6 months	(Whole pelvis - sex unknown) Transversely bisected across middle region of sacroiliac joint prior to accessing joint space.
Ovine #4	8-24 months	(Whole female pelvis) Transversely bisected across middle region of sacroiliac joint prior to accessing joint space.
Ovine #5	1 year	(Whole pelvis - sex unknown) Transversely bisected across middle region of sacroiliac joint prior to accessing joint space.

After removing surplus muscle, adipose tissue, and superfluous portions of the respective pelvic bones, the first sacroiliac joint (ovine No 1) was entered, using a bone saw, to systematically remove that part of the lateral surface of the ilium overlying the sacroiliac joint. Using repetitive blunt dissection technique on the iliac cartilage, the joint was finally entered from that iliac

side. It clearly revealed what appeared to be a ligamentous structure within the confines of the articular surfaces. It was a slow, laborious procedure due to the tough *plastic* nature of the cartilage. The technique was consistent with that employed by Illi.[1(pp 13)]

Using a bone saw, most of the sacrum was then removed in a sagittal plane on ovine #1's other sacroiliac joint. This time the joint was entered through the medial, or sacral aspect. The same ligamentous structure was again readily located, being only 3-4 millimetres from the interosseous ligament. This time however, the (sacral) cartilage was thicker, harder and much more difficult to remove. This observation was consistent with the differences in human sacral and iliac cartilage layers, as discussed by Bowen and Cassidy[33] and also Dihlman.[34]

The first juvenile bovine sacroiliac was then examined. Using the first 2 ovine examples, the estimated position of Illi's ligament was first marked on the external ala surface. Although access was difficult, the ligament was found at the expected site within the joint.

Due to the physical difficulty of gaining access in bovine #1's initial dissection, we feel the target ligament in #1's other sacroiliac joint may have been damaged in the process.

Due to the difficulty in removing the 'leathery' cartilage tissue of the iliac side on ovine #1 and bovine #1, we altered our technique for ovine #2. In order to access the sacroiliac joint space more easily, we removed the caudal section of the pelvis (at the level of the sciatic notch) through the body of the ilium. We then incised the anterior-inferior aspect of each joint from the caudal periphery. It was necessary to incise distal fibres of the caudal aspects of the interosseous and the weaker anterior sacroiliac ligaments.. On opening the joint space, a white 'ligamentous' structure could be seen at its superior internal margin of the joint.

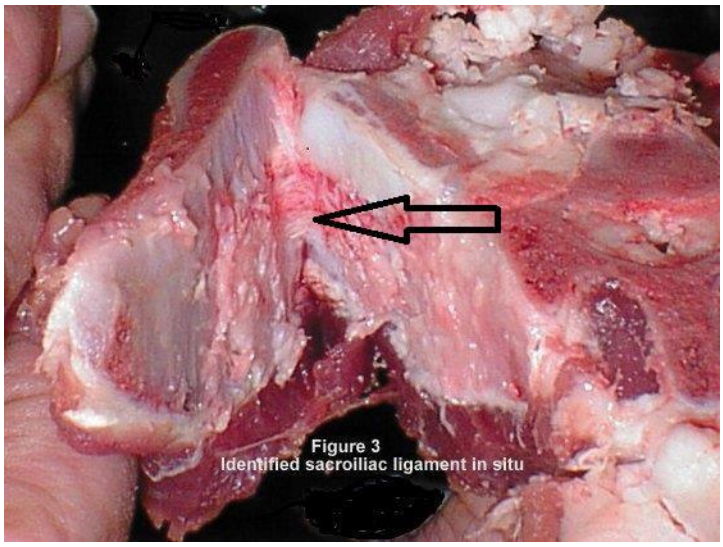
To gain even more rapid access, ovine #3 and all subsequent specimens were transversely bisected across the middle region of the joint. This approach was successfully employed by Freeman et al.[2] Then, with the superior half of the joint prised apart at the transected edge, the iliac and sacral segments could then be opened *like a book*. The target ligament was again readily identified and accessed. While this deviated from Illi's recommended approach, it consistently proved to be an effective and efficient mode of entry to the joint.

The ligament was found to be in the anterior-superior aspect of the joint, and was distinctly disconnected from all surrounding tissue. As it was readily isolated, the ligament was encircled with a cotton suture. This distinct separation had been noted by Freeman et al[2] and subsequently noted by Cramer and Darby.[17(pp 228-229)]

This ligature emphasised the observation that the ligament was separate from adjacent tissue and not attached to the joint capsule. However, Illi describes

it as arising just superior to the articular surface of the ilium, passing though the joint capsule and inserting ·5mm into the articular surface of the sacrum.[1(] pp 13)

That total joint with its intact sutured ligament was sent to a veterinary diagnostic laboratory for histopathological analysis.[40] (Figure 3a, 3b)



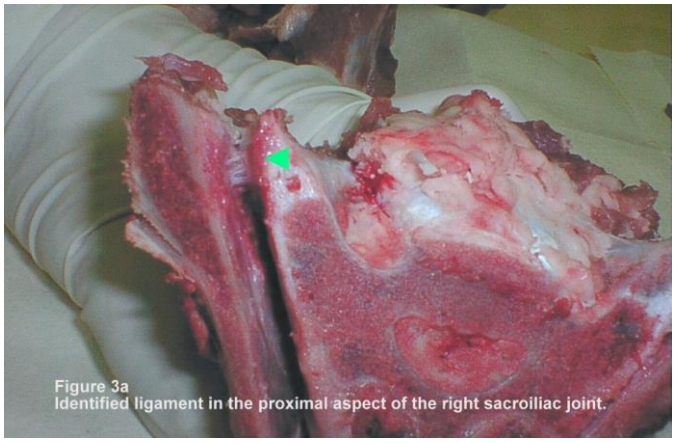


Figure 3a, 3b.

In essence, we found the most efficient approach was to firstly remove virtually all superfluous soft tissue with scalpels. This muscle and fatty tissue tended to restrict access to the area of interest. It was noticed that it also effectively limited joint movement. One whole joint was retained for histological examination. The majority of the joints were then transected for ready access. They were then gently prised apart with some slight severing of a small amount of interosseous ligament and any anterior ligament tissue. The joints' interiors could then be observed and Illi's ligament accessed.

RESULTS

Macroscopic Observations During Dissection
- The Lateral-To-Medial Approach in Arthrotomy of the Sacroiliac Articulation

This approach from the lateral or external surface of the ala was unremarkable until the surface of the medial iliac cortex surface was reached. From that point, well defined, hard cortical bone was encountered. As compared later, it was thicker, harder and more dense than the sacral cortex. The iliac cartilage of the sacroiliac joint appeared quite thin - estimated at 1mm, it was gelatinous, and somewhat opaque in nature.

The joint space itself appeared rather adhesive due to a matrix of short thin cylindrical fibrils attached to both surfaces. These were approximately 2mm in length in the mildly tractioned (manually widened) joint space. These thin, pinkish villi were easy to differentiate from the sought after ligamentous structure which appeared as tough, glistening and white.

The incidental but consistent finding of fibrovascular villi, even in young sheep, was of great interest - although their function is unclear. The findings did not appear to be correlated with degenerative changes, nor did the villi appear to be particularly strong. Accordingly, we doubt that they would have contributed materially to interarticular stability. However, given the profusion, they may have offered some cumulative impact to joint strength.

Dalin and Jeffcott indicated that these 'fibrous interconnections' or 'fibrous strands' appear early in the life of horses.[35] They examined them in more detail in a subsequent paper.[36-38]

This structure was interpreted by the authors to be Illi's ligament. It did not appear to be associated with the capsule, anterior sacroiliac or interosseous ligaments. It was revealed as a 1.5mm whitish 'trunk' with up to 5 contributing fascicles like the above-ground roots at the base of a tree in the iliac attachment. (Figs.4.) On the sacral surface this trunk measured approximately 3mm across the thicker base. This finding appeared to be contained within the articular surface. Subsequent microscopic histological examination identified the structure as ligamentous.[40] The structure was immediately adjacent to the anterior-superior perimeter of the articulation, but was not attached to a joint capsule. This absence of a capsule was later confirmed by the independent histological analysis from a veterinary pathology laboratory. The laboratory concluded the structure to be a '*normal ventral sacroiliac ligament*'. We would opine that use of the term 'ventral' is inconsistent with our own observations.

It is interesting to note that Gregory et al. state that a cranial sacroiliac ligament in canines is *"confluent with the dorsal and ventral sacroiliac ligaments"* - although it crosses that joint, it appears to be external to the joint capsule.[301]

In this primary specimen, there were also three other analogous yet smaller ligamentous-type interconnections within a 5mm radius of the identified main structure. These were of similar appearance. They were however thinner (1-2mm) than the primary ligament, but also different to the pinkish villi structures mentioned earlier. (Fig. 5.)

The articulating surface in the ovine auricular surfaces were on average, found to be considerably smaller than expected - just some 12mm x 22mm. The joint however, did retain the familiar 'boot' shape of the human sacroiliac joint.

Gross gliding movement of the joint became somewhat easier as peripheral muscular and adipose tissue was removed. As one could expect in an isolated but intact sacroiliac joint, following gradual removal of ligamentous tissue, even minimal finger pressure produced smooth slippage of the joint surfaces with remarkably negligible friction.

Interestingly, the more mature sheep's sacroiliacs seemed more mobile than the younger specimens. Macroscopically, these older ovine specimens did not show signs of degenerative change, although as mature sheep, they would not have been *elderly*.

The range of movement of the isolated sacroiliac joint was estimated to be 3 to 4 times greater than an intact sacroiliac joint. The sliding movement of the resected joint surfaces was more resistant towards the anterior than posterior. This relatively easy translation of the sacral surface posteriorly (i.e. relative to movement of ilium anteriorly) within its physiological limits, appeared to counter the natural tendency of sacral nutation. In support of Illi's concepts, this may indicate that greater stabilising strength of sacral movement is required in physiological nutation.[1]

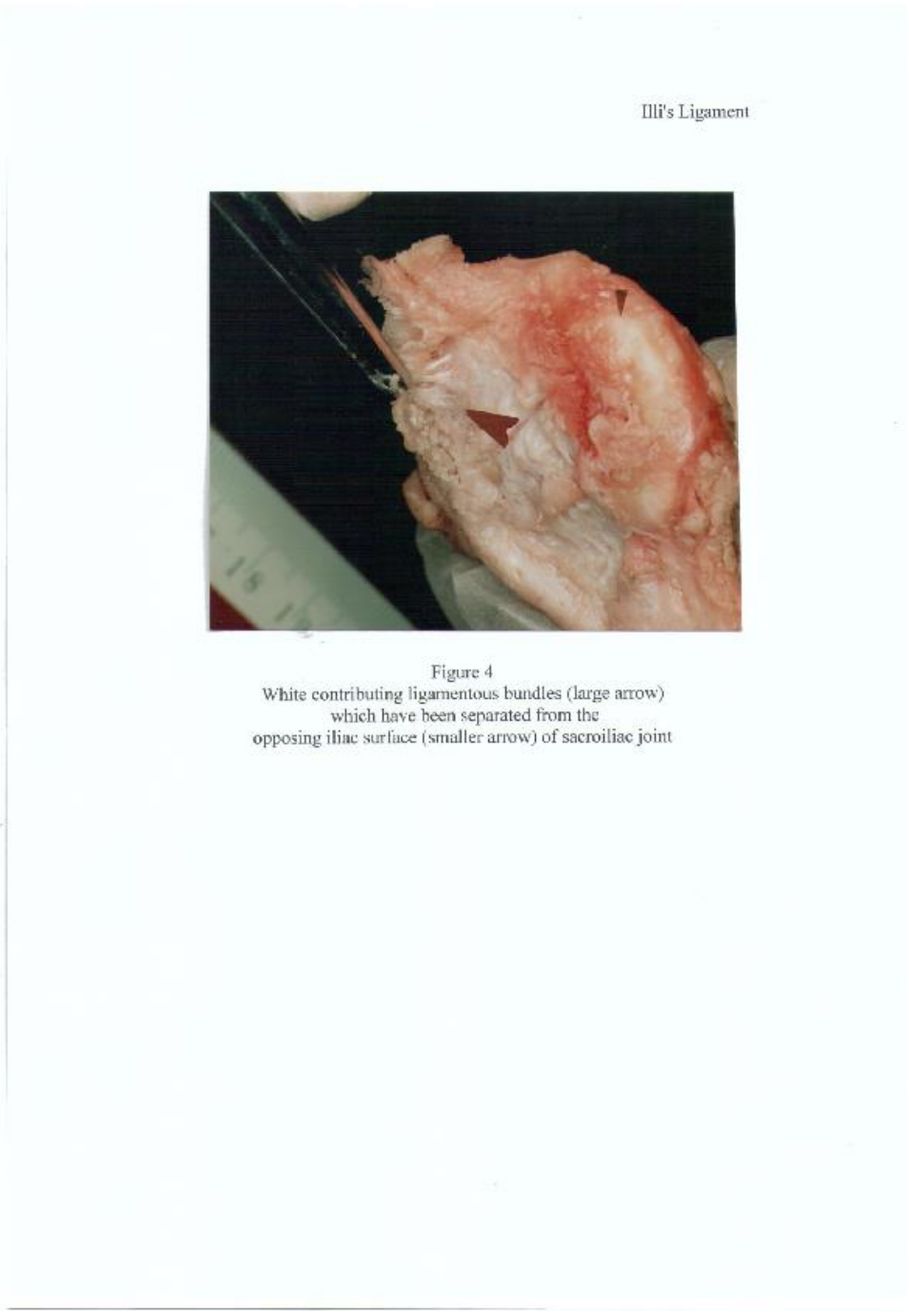


Figure 4. Contributing ligaments.

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Gregory and colleagues also noted this significant increase in range of movement of the joint just by severing the sacrotuberous ligaments, and naturally more so on severing the periarticular ligaments.[30]

The initial ovine dissection raised our expectations, as we interpreted the readily identified structure that had been resected as Illi's ligament at this very first attempt.

The Medial-To-Lateral Approach to the Sacroiliac Articulation
After removing much of the sacrum with a bone saw in ovine #1's second sacroiliac joint, the rest of the sacral tissue appeared softer, and was relatively quicker and easier to remove than the denser iliac cortical layers. Macroscopically, it was observed that there was appreciably less cortical bone on this sacral side of the sacroiliac joint.

Immediately adjacent and attached to the sacral cortex surface at the sacroiliac joint, was a dense plate of thick, white, hard cartilage tissue. This would seem to compensate for the minimal cortical bone density on the sacral surface, and was in distinct contrast to the iliac cartilage.

Once again on entering the joint, a structure deemed to be Illi's ligament was identified - its white tissue was distinctly separate from the nearby anterior ligament and capsule. It was located at the anterior-superior aspect of the sacroiliac articulation and was ligamentous in appearance.

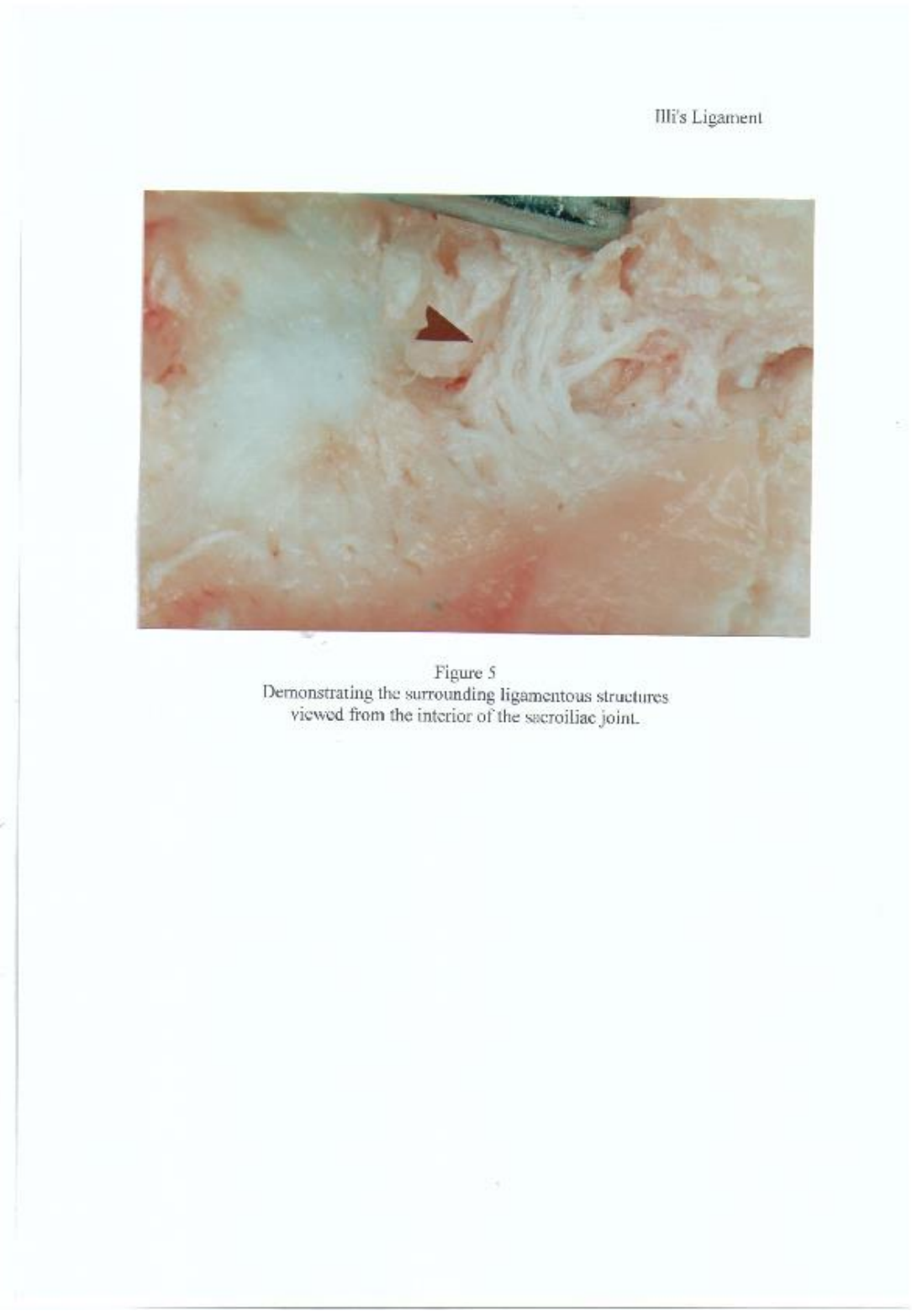

Figure 5
Demonstrating the surrounding ligamentous structures viewed from the interior of the sacroiliac joint.

Figure 5. Surrounding ligamentous structures.

Microscopic Observations

An independent opinion and analysis was sought from a veterinary histopathology laboratory.[40] The report stated; *"The section from the*

> *anterior ligament area consisted of dense fibrous tissue adjacent to an area of fatty connective tissue and an area where the dense connective tissue merges into an area consisting of dense connective tissue containing cartilage.*
>
> *The dense connective tissue consists of linear bundles of mature collagen interspersed by narrow fibroblasts oriented in a linear fashion between collagen bundles."*
> The report concluded; *"Dense fibrous connective tissue consistent with ligament tissue."*

A definition of collagenous connective tissue (CCT) as mentioned in the histopathology report appears to differentiate it from pure ligamentous tissue in that CCT is defined as being *a part* of both the tendon and ligamentous tissue:

> *"Dense regular collagenous connective tissue consists of densely packed collagen fibers that are arranged in parallel to one another. This arrangement creates a tissue that is very strong at resisting tensile forces in one direction. This tissue is common to the tendons of muscles and many of the ligaments of the body."* [41] "*It is found wherever the tensile strength of collagen is of paramount importance."* [42]

Kangaroo Specimen

For comparative purposes, the authors followed up on this project by examining both sacroiliac joints from a single kangaroo specimen.

We hypothesised that given the nature of the kangaroo's bipedal hopping gait, stress forces on the ligamentous structures of the sacroiliac articulations might be exaggerated when compared to quadrupeds. This proved *not* to be the case in a number of respects.

A farming patient who was aware of our interest, provided us with a kangaroo pelvis from a *roadkill*. This pelvis was comparatively elongated and narrower than expected. The supplier indicated this marsupial mammal was an Eastern Grey (*Macropus giganteus*) male, estimated to be about 2 years of age with an approximate a height of 120 cm.

After removing the extraneous muscle tissue, some additional 3-4mm of movement in the articulations was noted.

The articulation was then accessed by sawing transversely across the ilium and sacrum, removing some 2mm off the inferior aspect of the joint.

The larger remaining portion of the articulation was then opened by dissecting the anterior sacroiliac ligament. This was easily carried out as this anterior sacroiliac ligament seemed thin, almost like a capsular ligament. It was easily resected to expose the rest of the articular surfaces. No intra-articular ligament was observed within this flap section. Unlike ovine specimens, no intra-articular villi were observed either.

The gross anatomical observations revealed some surprising findings.

The sacroiliac joint seemed small for an animal of this size especially considering the jarring impact of its bounding gait.

Each articulation measured an inferior to superior length of 26mm and an anterior to posterior width of 24mm.

These surfaces appeared to be more arthrodial rather than amphiarthrodial in structure. Macroscopically, both cartilage surfaces appeared to be similar and particularly thin. Unlike the ovine specimens, there was no thick layer of cartilage on the sacral articular surface.

The posterior sacroiliac ligament was very dense and covered some 25% of the area investigated. It appeared to blend with the interosseous sacroiliac ligament.

An intra-articular ridge was exposed in the inferior wing of the articulation. This measured some 17mm in length and some 6mm in width at it widest part.

However, no evidence of Illi's ligament was found in either of these kangaroo sacroiliac joints.

CONCLUSION

Of the 14 sacroiliac articulations examined, all but 1 revealed a readily identified target structure. The best specimen, which was thought to potentially exhibit *Illi's Ligament* was easily sutured as an isolated structure. It was near, but distinctly separated from the anterior sacroiliac ligament.

We feel that at least macroscopically, a ligamentous-type structure was located in a predictable site within the sacroiliac articulation. Further, that the structure was consistent to that identified by Illi and others in human sacroiliac articulations,

We also found not to be necessary to conduct the dissection in accordance with Illi's recommended technique[1], but more in accordance with that of Freeman et al.[2] Based on our findings of ovine and bovine specimens, we cannot explain why Illi found his dissection approach the only way to isolate the ligament in humans.

The innumerable intra-articular villi presented an incidental finding in quadruped sacroiliac joints. Our research did not clearly identify the role of these connecting fibril-like structures.

The histology report nominated the structure as the *anterior ligament* of the sacroiliac joint. Use of this term in the report would tend to contradict our observation. In gross observation however, the ligament was isolated and intra-articular, with no contact with the capsule or other ligamentous structures.

As this ligament does not appear to be identified in human or veterinary textbooks, one would not expect it to be identified by traditional histopathologists as Illi's ligament, an intra-articular ligament, or an intracapsular ligament.

An ambiguous feature was highlighted in the literature research related to this project. The range in nomenclature for the sacroiliac ligaments suggests a need for standardisation.

Freeman et al refer to Illi's ligament as an *intracapsular* ligament, while Illi himself refers to it as an *intra-articular* ligament.[1(pp12-14)] Our findings are consistent with these overall descriptions.

We submit that the mammalian evidence presented here, provides supporting findings as to the possible existence of Illi's ligament in man.[1,2,9,10] Following the study by Freeman, Fox and Richards,[2] additional research is required to elucidate the issues of the anatomical and physiological necessity for such an intracapsular sacroiliac ligament, and its assumed role in providing additional vertical stability in human erect posture - as proposed by Illi.

We were able to easily loop a suture around the identified structure at the cephalic section of the articulation, from and through the inferior aspect of the intact joint.

Further studies on this ligament in other species, such as ratites like the emu (*Dromaius novae-hollandiae*) and the ostrich (*Struthio camelus*), macropods (kangaroo and wallaby), and even primates, may provide further insight as to the potential importance and recognition of this intra-articular structure. (Appendix A) These may reveal a phylogenetic tendency of Illi's ligament. The extraordinary stresses in a wallaby or kangaroo sacroiliac joints in particular, would be of particular interest in relation to this topic, despite the cursory finding on the kangaroo sacroiliac joints presented here.

Despite this possible confirmation of an Illi's ligament, it has yet to be recognised as such in the formal anatomical literature. It is submitted that the recent acknowledgement by Egund and Jurik of a *proximal transverse sacroiliac ligament* (PSIL) would seem to be at least tacit recognition of this ligament in humans.[14,15]

We would conclude that at this stage, the indication is that the designated Illi's ligament is a part of mammalian sacroiliacs. Further mammalian studies would be necessary to make conclusive findings on the subject.

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