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Morphological and Histological Prenatal Studies on Some Structures of the Developing Human Knee Joint: Part -5 some observations on the embryogenesis and histogenesis of the anterior cruciate ligament ACL of the prenatal developing human Knee-joint (Articulatio Genu).

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Abstract: The present work studies some aspects of morphogenesis and histogenesis of the developing intra-articular septum (ACL cruciate primordium) of the prenatal human knee joint, and emerging of the cruciate and meniscofemoral ligaments from that septum. Thirty three33knee joints of male and female fetuses were used, besides 4 adult knee joints. Fetuses aged3 months(12-13wks-CRL 8- 9cm,4 months (13-16wks-CRL 9-14cm),5months (17 - 20weeks) CRL 15-19cm, 6months (21 -24weeks) CRL 20-23cm, 7-months (25-28weeks) CRL 24-27cm,8 months (29-32 weeks) CRL 28-30cm and full term (33-36 weeks) CRL 31-34cm) aged fetuses were used. Morphological study of the developing intra-articular septum of the human knee joint revealed that, in the ages of 3,4,5,6, months old fetuses, the joint cavity had a broad septum (septum genu) that divided the joint cavity into two cavities, resulting of two condylar joints between the medial and lateral condyles of the femur and the corresponding tibial condyles .That septum decreased in broadness and differentiated in consecutive stages and steps with age progress. At the age of 3months fetus, a septum was detected in the small knee joint cavity. At the age of 4months fetus, the septum was not uniform in thickness. At the age of 5months fetus,the septum had in its middle and periphery , tiny round thickened areas and bands, which increased in size, number and differentiation with age progress, and appeared clearly in the age of 8monts ,then differentiation was complete at full term by the emerging of 2cruciate ligaments anterior and posterior ACL &PCL and meniscofemoral MFL ligaments from the intra-articular septum. . Pits and foramina appeared at the medial and lateral edges of that intra-articular septum at the ages of 4,5and 6months with additional pit appearance at its upper part at the age of 7months fetus. The intra-articular septum was absorbed at full term fetus and was differentiated into 3 bands: the menisco-femoral MFL ligament ,the anterior ACL and posterior PCL cruciate ligaments. Histological examination of the ACL primordium at age 5month fetus showed that the ligament was formed of tissue contained loosely packed short collagen bundles and large fibroblasts. At full term, the collagen bundles branched, became wavy, closely packed longer forming network, besides intermingled fibroblasts and fibrocytes among the collagen bundles were seen. Some radial collagen bundles were noted and that might to resist twisting of the ACL. At the age of 5months and full term, thin fibrils in between the long collagen bundles were seen, indicating different types of collagen in the prenatal ACL .The ACL of the full term showed metachromatic reaction in the extra cellular matrix ECM. Adult ACL had very thick wavy branched collagen bundles and big oval cells and fine fibrils present between the collagen bundles were noted indicating more than one type of collagen in adult ACL. At the tibial attachment of the adult ACL ,different histological appearance from all the ACL tissue ,and the ACL was fibrocartilage with excess collagen and large oval cells ,single or in two cells having twin appearance arranged in rows between the collagen. The fibrocartilage at the attachment of adult ACL was to strengthen and fortify the ACL tissue to accommodate knee joint kinematics and function. Fibrocartilage tissue was not noted in the previous prenatal ages studied in the present work. Histological examination of TS sections stained by Silver impregnation –Gordon and Sweet stain of parts of ACL in full term fetus showed the presence of various mechanoreceptors like structures occupying large area of ACL. Large Pacinian corpuscle with lamellate cells around a core and the capsule continued with the pernuierium ,spindle shaped structures with one axon ,single large oval Golgi tendon-like organ , Raffini –like corpuscles with button endings were noted .Mieseners corpuscle like structure with zigzaz or striated appearance, spray ,enlarged varicosity end structure, and flower like structures were detected .besides free nerve endings FNE and nerve plexus. The mechanoreceptors and FNE in the ACL indicated sensory function of the prenatal ACL in the human knee joint. Conclusion: The developing prenatal human knee joint at the age of 3 and 4 months fetuses had in

its cavity an intra-articular septum with not uniform thickness, dividing the joint cavity into two joints. That septum decreased in broadness with age progress .Tiny thickened round areas and bands appeared in that septum which increased in size, number, prominence and differentiation with age progress. Foramina and pits appeared at the medial and lateral sides of the intra-articular septum at the ages of 5,6,,then in the upper part at the age of 7.At the age of 8months fetus, 5-6prominent thickened round areas and bands were noted in the middle of the septum . The thickened round areas and bands seen at the intra articular septum of the 8 months fetus might be the precursors of the various functional bands of the future adult anterior ACL. Posterior PCL and the meniscofemoral ligaments MFL. The foramina and pits at the edges of the septum increased in width, while the septum decreased in broadness with age progress. At full term, absorption of the intra-articular septum occurred and complete differentiation of ACL, PCL and MFL ligaments were noted. The adult cruciate ligaments were seen as strong thick fibrous bands in the knee joint cavity. The various mechano-neuro receptors and free nerve endings FNE in the ACL of full term fetus indicated sensory function in the prenatal developing human kn joint. Summary and Conclusion: An intra articular septum was noted at the ages of 3, 4,5months aged fetus .That septum represented the ACL premordium in the prenatal developing human knee joint. At age5 months ,tiny thickened round areas and bands in appeared in that septum, At age 8 months fetus that septum decreased in broadness and the thickened round areas and bands appeared more prominent and increased in size and number in the middle of that septum. These thickened areas might be the multiple different future functional tissue bands of ACL, PCL and MFL. At full term the septum was differentiated to ACL.PCLand MFL and the intra-articular septum was absorbed. Adult ACL was fibro cartilage at the attachment sites with excess collagen to strengthen and fortify the ACL and knee joint to accommodate for the knee joint function and kinematics. That was fibro cartilage tissue was not noted in the previous prenatal ages studied in the present work. That was mentioned in the Holy Quran Suret el ensane 28 and suret al haj 5 ashodakom, suret kafer (forgiver) 67, and suret Al ah akaf.15. The morphogenesis and histogenesis changes observed in the developing intra articular septum in the human knee joint of the prenatal developing ages in the present study ,and then the changes in the adult ACL at its attached areas might correspond to what mentioned in the Qura n suret al enfetar 7(kalakaka, fa sawak, fa adalak).:Allah created the human then completed the creation in stages .(Suret Sad72 and Suret Al hijr 29). The word sawa and its derivatives was mentioned also in suret Al shams 7(the sun). Sawaytoho mentioned in the book of Galaleen, the explanation of the meaning of Quraan meant completion of the creation of human. Suret A keyama38, and Al Alala 2, (the highest)., Suret Al sajida 9. The changes that occurred in the intra-articular septum were in consecutive stages ,step following step خلقا من بعد حلق,creation after creation as mentioned in suret al zomarالزم , verse 6 and suret Nooh verse14:atwaraاطوار.And Allah the most merciful who knows. Conclusion: The ACL premordium at 5months aged fetus was noted as a septum intra articular in the cavity of the prenatal developing human knee having tiny thickened areas and pits and foramen at its medial and lateral edges. The pits and foramina at the medial and lateral side of the septum increased in size with additional appearance of upper pits at the age of 7months, while the septum decreased in broadness with age progress. At age 8months fetus that septum decreased in broadness and the thickened round areas and bands increased in prominence, number and differentiation till absorption of the intra-articuar septum and emerging of the cruciateACL&PCL and MF ligaments`at full term ... The thickened round areas and tissue bands might be the future different types of the functional tissue bands of ACL, PCL and MFL. Mechanorecetors and FNE were detected in ACL of full term fetus, which indicated sensory function in the prenatal developing human knee joint. Thanks to Allah we established for the first time the stages of emerging of the cruciate ligaments and meniscofemoral ligaments from the developing prenatal intra articular septum of the human knee joint *septum genu)and confirmed the presence of mechanoreceptors in the prenatal human knee joint.

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Introduction:

Mesenchymal condensations had been described in specimens with a crown–rump length of 7–12 mm (O'Rahilly et al. 1956) or 10–14 mm (Genis, 1970),

Some investigations about the knee joint showed that the first sign of joint formation was the appearance of an interzone in the condensed mesenchymal structure (which was the foreshaing of the developing skeleton in early embryonic limbs), and that interzone cells had special cell characteristics that distinguished them from the condensed mesenchyme of neighboring skeletal anlagen (Archer et al., 2003). The interzonal

mesenchyme of developing synovial joints became trilaminar as a more tenuous intermediate zone appeared; splitting the mesenchyme into two dense satrata next to the cartilaginous ends of the skeletal elements of the region. As the dense strata of the interzonal mesenchyme became cartilaginous, a following cavitation of the intermediate zone established the cavity of the joint. The vascularized loose mesenchyme around the cavity formed the synovial membrane (*stratum synoviale*) and probably also gave rise to all other intra-articular structures (Gardner, 1963; Genis, 1970; Moore & Persaud, 2000)

The embryonic period had been divided into 23 developmental stages based on external and internal morphological criteria. Stages 10–23 were described in detail by Streeter (1951), and the entire system was revised by O'Rahilly & Müller (1987).

More than one cavity might appear in joints containing discs and menisci, merging, later into a complex single one cavity. As thickening of the fibrous capsule could be recognized with proceeded development, some thickening of the joints, capsule was derived from neighboring tendons. (Gardner and O'rahilly, 1968 and Williams et at, 1989).

Doskoil (1984), studied the human knee joint during the period in which the joint gap developed. He found that the knee joint contained a high broad septum which he called (The mediastinum genus) in which there were many blood vessels. Those vessels fed the cruciate ligaments analogs, the meniscus analogs , the cartilaginous and the adjacent bone analogs .In the human embryo .The mediastinum genus had splitted the knee joint into a lateral and a medial halves. Communication between these two halves was between the small contact surface of the patella and femur analogs. However, further differentiation of that mediastinum genus had not reported sufficiently in the literature.

Bellelli et al. (1996) studied the Synovial cyst of the cruciate ligament with magnetic resonance in 8 symptomatic cases; and mentioned that the intra-articular cyst was uncommon finding: only 30 cases had been reported since the first paper by Caan in 1924, and they were all associated with cruciate ligaments. Many different cystic or pseudocystic lesions were found in articular knee joint conditions; the most common cystic lesions were popliteal cysts (Baker· s cysts), followed by Synovial pseudo cyst of the posterior cruciate ligament, meniscal cysts and finally ganglionic cyst of the anterior cruciate ligaments. In their series of 1600 knee MR exams carried out in their MR department since June, 1994, they had found 8 ganglionic cysts of the cruciate ligaments MR studies were performed on dedicated 0.2-T permanent magnet (Artoscan, Esaote Biomedica, Genoa, Italy). Five patients were operated on with arthroscopy. The ganglionic cysts affected the anterior cruciate ligaments in 4 cases and the posterior cruciate ligaments in 4 cases. The symptoms were mainly pain radiating to the medial side and worsening in flexion and extension. The diagnostic suspicion was meniscal tears in 3 patients, chondral lesion in 3, and loose intra-articular body in one patient. The shape and structure of the ganglionic cysts in the cruciate ligaments were clearly depicted with MRI. The ganglionic cysts in the anterior cruciate ligaments were usually spindle shaped and within the ligament, while those in the posterior cruciate ligaments had a well-defined outline, with multi locular appearance and most often on the dorsal aspect. MR signal studies showed intermediate signal intensity on SE T1-weghted images and markedly increased signal intensity on SE T2-weghted images. This typical pattern might change depending on lesion content. The origin of the ganglionic cysts in the cruciate ligaments was still unknown, even though many theories had been suggested, including a synovial herniation in the ligament fibers, the ectopic inclusion of synovial tissue, a post traumatic connective degeneration and,finally the proliferation of totipotent mesenchymal cells. They pointed that from histological point of view,"synovial ganglion" was much better definition than "synovial ganglion cyst", because the typical wall of the real synovial cyst was missing .The MR patterns were typical of the morphological features described and the presence of high protein fluid content

Mérida-Velasco et al. (1997) reported that different investigators disagreed on the morphogenetic time table of the human knee joint. Most discrepancies centered on the cavitation of the knee joint and the participation of the superior tibiofibular joint in the joint knee system. They concluded their observations of the development of the knee joint in 50 serially sectioned human embryonic and fetal lower limbs (26 embryos and 24 fetuses). They established the morphogenetic time table of the human knee joint. They reported that epiphysis of the femur and tibia became countrified from O'Rahilly stage 18, and ossification began during the 13th week of development. The patella appeared as a dense blastema during O'Rahilly stage 19, became condryfied during O'Rahilly stage 22, and began its ossification during the 14th week of development. The knee joint cavity appeared during O'Rahilly stage 22, initially as the femoropatellar joint.

That process began at the periphery of the articular interzone. The superior tibiofibular joint communicated with the lateral meniscotibial joint between 10 and 11 weeks of development and became separated from the 13 week on. The menisci arised from the eccentric portions of the articular interzone during O'Rahilly stage 22; however, until week 9 of development, they were not easily distinguishable.

Ratajczak (2000) observed the homogeneous interzone of the future knee joint in embryos at stage 18, after investigating 43 serially sectioned human embryos of developmental stages 18 to 23. They mentioned that during stage 19, the interzone was differentiated into dense, intensively stained, peripheral parts, which were the primordia of menisci and the medial portion, in which the cruciate ligaments were formed. All structures of the interior of the knee joint were more clearly delineated during stage 20, and they were well developed during the last embryonic week (stages 21-23).

Gilroy (2013) mentioned that the cruciate ligaments were located within the knee joint capsule but laid external to the synovial layer .They provided stability in all positions, in addition to limiting rotation and preventing anterior and posterior dislocation of the knee joint.

Standring et al. (2016) mentioned that the cruciate ligaments so named because they crossed each other .They were very strong richly innervated intracapsular structures , The point of crossing was located little posterior to the articular center. They were named anterior and posterior with reference to their tibial attachments. The synovial membrane almost surrounded the ligaments but was reflected posteriorly from posterior cruciate ligament to adjoining parts of the capsule; the intercondylar part of the posterior region of the fibrous capsules therefore had no synovial covering.

Snell (2010) and Splittgerber (2019) reported that four types of sensory endings could be located in the capsule and ligaments of synovial joints. Three of these endings were capsulated and resembled Pacinian, and tendon stretch receptors. They provided the CNS with information regarding the position and movements of the joint. A fourth type of ending was nonencapsulted and was thought to be sensitive to excessive movements and to transmit pain sensation.

Sadler (2019) mentioned that the synovial joints between the bones began to be formed at the same time that the mesenchyme condensations initiated the process of forming cartilage ,Thus in the region between chondrifying bone primordial, called the interzone (e.g between the tibia and femur at the knee joint) the condensed mesenchyme differentiated into dense fibrous tissue ,that fibrous tissue then formed articular cartilage covering the ends of the two adjacent bones, the synovial membranes, and the menisci and ligaments within the joint capsule (e,g the anterior and posterior cruciate ligaments in the knee).The joint capsule itself was derived from mesenchyme cells surrounding the interzone region.

Wineski (2019) mentioned that the anterior cruciate ligament ACL attached to the anterior intercondylar area of the tibia and passed upward backward, and laterally to attach to the posterior part of the medial surface of the lateral femoral condyle. The ACL prevented the posterior displacement of the femur on the tibia. Conversely, with the knee joint flexed, the ACL prevented the tibia from being positioned anteriorly. The anterior cruciate ligament ACL arose from the anterior intercondylar part of the tibia and extended posterolateraly to the medial aspect of the lateral femoral condyle.

Banios et al. (2022) reviewed the current knowledge of anterior and posterior cruciate ligaments and grafts mechanoreceptors, and their role in proprioception of knee joint, focusing on each type of mechanoreceptors.bThey mentioned that proprioception was a specialized sensory modality involving the joint movement and its position in space, besides conversion of mechanical

Deformation of tissues into neural signals. Mechanoreceptors were specialized nerve structures abled to transmit mechanical deformation through electrical signals to neurons of dorsal root sensory ganglia and were abundant in the muscles, ligaments and tendons of the knee joint. They were believed to play an important role in knee stability, proprioception and dynamic. Proprioception should be considered for successful reconstruction of the cruciate-deficient knee and management for function and pain in the arthritic knee. Advances in histological methods for detection of mechanoreceptors role were numerous and continued to highlight their role and presence after ligament reconstruction, depending on graft choice.

They concluded that further research was required to fully understand the role of mechanoreceptors. Understanding the role of MRCs in knee kinematics would provide more information about the proprioceptive deficiencies accompanied ligament ruptures and the pathogeneses of knee arthrosis. Patients at risk for MRCs-deficient knees had to be managed with special rehabilitation protocols to compensate for proprioception loss and kinesthesia.

Banios et al. (2022) pointed that there were four types of MRCs classified by Freeman and Wyke: Type I: corpuscles of Ruffini slowly adapting receptors—low-threshold, that responded to mechanical stress. Ruffini endings appeared to be stimulated by displacement of the collagen fibers with which they were intertwined. The characteristics of those receptors categorized them as static and dynamic mechanoreceptors, transmitting information about static position, changes in intra-articular, pressure, amplitude, direction and velocity of the joint movements.

Type II: corpuscles of Vater-Pacini—dynamic, rapidly adapting mechanoreceptors with a low threshold. They were entirely inactive in immobile joints, becoming active only at the onset or cessation of

joint movement, moments at which sudden changes of stress occurred.

Type III: corpuscles of Golgi—high threshold, slowly adapting mechanoreceptors that were completely inactive in immobile joints. They became active only in extreme ranges of movement and when considerable stress was generated in the joint.

Type IV: free nerve endings-high-threshold, non-adapting pain receptors.

Various histological methods had been used in identifying MRCs mostly using the gold chloride method

1. Lately, Banios et al. (2022) reported that immunological methods using specific antigen antibody reactions had been increasingly utilized. Immunological methods were more reliable and easier to use compared to the traditional methods of histological staining. Histological staining methods most commonly identified the structurally normal MRCs only, while the immunological stains identified the functionally viable MRCs. Three antibodies were widely used in immunohistochemical analysis of neuronal structures and had proven to be the most reliable method in the detection of MRCs: the polyclonal antibody against S-100, the one against p75 and the monoclonal antibody against PGP9.5 Rebmann, et al., 2020D

Recently, interest mechanoreceptors (MRCs) presence and function that were responsible for proprioceptive function in the ACL and PCL had occurred. However, the review of literature showed that the anatomical and histological studies on the developing prenatal anterior cruciate ligament (ACL) of the human knee joint were insufficiently reported. Further studies are needed to abtain more knowledge about the morphogenesis and histogenesis of the developing prenatal anterior cruciate ligament ACL of human knee joint and its mechanoreceptors (MRCs). The current work aims to study some morphological and histological changes of the prenatal developing anterior cruciate ligament of the human knee join and its neuro and its mechanoreceptors (MRCs). t. from the age of 3 months till full term, and compare with the adult human knee joint, and (ii) determine the sequence of chondrogenic events that took place in the prenatal developing human knee joint , (iii) to establish the normal pattern of emergence and development of ligaments cruciate ligament ACL. This is fundamental in understanding the knee joint biomechanics,mechanoreceptors and sensation, which is essential in correction and treatment of knee lesions, reconstruction and graft placement, which are crucial in Orthopedic Surgery, Physiotherapy Clinical Anatomy.

Material & Methods:

Material & Methods: A total of thirty three 33 Human (male and female) fresh fetuses aged 3, 4, 5, 6, 7, 8 and 9 months(full term) 3-9 months old fetuses (12-13wks-CRL 8- 9cm)to full-term :(33- 36 weeks) CRL 31-34cm) and new born infant) 37- 38 weeks) CRL 35-36cm) were used in this investigation. The fetuses were obtained from the miscarriage and spontaneous abortion obtained with no maceration or external abnormalities from Gynecology and Obstetrics Department Al -Zharaa hospital-Cairo -Egypt (according to medical ethics) . Four 4 adult knee joints from new cadavers (male and female) were used in for comparison. The cadavers were obtained from the Dissection room at the – Anatomy Department -Al Azhar University (Girls)-Cairo -Egypt .Dissection of both sides of the developing and adult knees was done according to Romanes (2000) in three stages: a) To expose the structures of the joint's cavity, by cutting across the quadriceps tendon immediately proximal to patella. Then the latter was turned downwards. followed by displacement of the capsule ;b) A deeper dissection was done to expose the intra articular structures, by removing the infrapatellar synovial fold and fat, then the infrapatellar bursa was opened. c) A clear view of the upper surface of the tibia was obtained after cutting across the fibular and tibial collateral ligaments, the arcuate ligament, tendon of popliteus and the remains of the fibrous capsule. Followed by cutting across the cruciate ligaments. Then ACL specimens were fixed in formalin. To illustrate the morphogenesis and histogenesis of theprenatal developing ACL of the knee joints, photos were photographed by Canon camera zoom . (The anterior aspect in full flexion position and the quadriceps tendon in each joint was sectioned and the patellar flap retracted distally).(Adult knee photos were photographed by Yashica T3 Super D-Carl Zeiss T –Tessar 2-8/35) . For histological study, specimens from the anterior cruciate ligaments AC L of 5 months fetuses :(33-36 weeks) CRL 31-34cm) and full term:(33-36 weeks) CRL 31-34cm) were collected freshly and fixed in 10% formal saline solution for 10 days, then dehydrated, cleared in benzene, embedded in paraffin wax, cut serially at 7 microns thickness and stained with haematoxylin and eosin stain for detection of general histological structures, Mallory's triple stain to investigate collagenous tissue ,Masson trichrome stain for evaluation of collagenous tissue, toluidine blue to detect metachromatic reaction and silver impregnation – Gordon and sweet to detect mechanoreceptors and free nerve endings (Drury & Walington, 1980). The CRL of each fetus was obtained and then converted into weeks of menstrual prenatal ages according to tables of Streeter (1920), and Sadler (2012 and Sadler (2019).and Abdelwahab et al 2018 patr 1&2

Results: Figs 1-14&tables 1&2)

A -Morphological Results:

General morphological examination of the developing knee joint of 3-9 months old fetuses from (12-13wks-CRL 8- 9cm)to full-term :(33-36 weeks) CRL 31-34cm) ,anterior aspect in full flexion position , showed that besides the increase knee joints sizes with age progress, a broad intra-articular septum was detected specially in young ages. That septum became narrower with age progress. Thickened bands and tiny rounder areas (colliculi) appeared at age 4month .These thickenings increased in size with age progress till emerging of the cruciate ligaments and meniscofemoral ligament in full term. At the age of 4months aged fetus, some foramina and pits appeared at the medial and lateral edges of the intra-articular septum. The number and size of foramina and pits increases with age progress. Some additional pits appeared at points of attachment with the femur at the age of 7month fetus and the septum became more narrow. The thickened bands and colliculi were clear at the age of 8months fetus and these might be the precursors of the different functional bands in the cruciate ligaments Fig. (A).

Morphological examination of the knee joint of 3 months old fetus (12-13wks-CRL 8- 9cm) anterior aspect in full flexion position, showed the presence of middle intra -articular broad septum , separating the joint's cavity into medial and lateral halves, Two condylar joints were resulted between the medial and lateral condyles of the femur and the corresponding condyles of the tibia. Fig. (AA)

Morphological examination of a left knee joint of 4 months old fetus(13-16wks-CRL 9-14cm) showed that the joint was small .A middle intra -articular broad septum was detected, separating the joint cavity into medial and lateral parts, two condylar joints were resulted between the medial and lateral condyles of the femur and the corresponding condyles of the tibia. The septum was not uniform in thickening. (Fig. A)

Morphological examination of a left knee joint of 5 months old fetus :(17 -20weeks) CRL 15-19cm. showed convex lateral surface of the lateral femoral condyle. The latter condyle had the same level of downward extension as the medial condyle. The broad intra-articular septum, between the medial and lateral condyles. It had large medial foramen and a lateral depression or pit. Multiple very tiny rounded thickened (colliculi) appeared. A small pit was noted in the upper part of the intra articular septum (Fig. B).

Morphological examination of left knee of 6-months old fetus: (21-24weeks) CRL 20-23cm showed that the medial condyle was larger in size than the lateral condyle. The lateral surface of the lateral condyle was compressed laterally. Reflection of part of the synovial membrane on the lateral condyle was noted (Fig. C).The broad intra-articular septum had two lateral pits and a medial large foramen which made the septum narrower than the previous age. Thickened areas in the septum were noted.

Morphological examination of the right knee joint of 7-months old fetus :(25-28weeks) CRL 24-27cm showed a narrower intra-articular septum than the previous age and the appearance of additional foramina in the upper part of that septum besides the previous foramina. Areas of detachment of the septum from the intercondyler fossa of the femur were noted (Fig. C-2)

Morphological examination of the left knee joint of 8 months old :(29-32 weeks) CRL 28-30cm)fetus showed the differentiation of two small bands from the middle part of the intra-articular septum which was narrower in size than the previous aged fetuses ,The tiny round (collicular) thickenings increased in size, number and prominence in the septum and were more differentiation than the previous age (Fig . D)

Morphological examination of a right knee joint of human full term :(33-36 weeks) CRL 31-34cm) (Figs.E&EE) and newborn infant (37-38 weeks) CRL 35-36cm (Fig. E-1& Fig. E-2)showed that the intra articular septum was between the femoral condyles and differentiated into three bands, posterior PCL and anterior cruciate ligaments ACL besides menisco femoral ligaments . Figs. (E&E-2) Antro lateral view showed that the intra articular septum was between the femoral condyles and a posterior and anterior cruciate ligaments besides menisco femoral ligaments MFLin relation to the posterior cruciate ligament appeared. MFL appeared as thick cord like bands anterior aMFLligament of HUMPHREY and pMFLposterior menisco femoral ligament of Wrisbergs. The menisco femoral ligaments.MFL was as secondary supports for the knee joint. That mentioned in suret al Ensane 28 that Allah had created the human and supported strengthened and fortified his joints and organs by supports as in the present study the support was represented by ligaments cruciate ligaments and. MFL (Figs.E &E-E)

.الحمد لله تفسير الجلالين: سورة الأنسان 28 - خلقناهم وشددنا أسرهم : شددنا :قوينا

.أسرهم : أعضاءهم ومفاصله

Figs. (E&E-1) &(E-2)

Morphological examination of a left knee of newborn infant (37-38 weeks) CRL 35-36cm) Figs (E-1and E-2) showed that the medial condyle and the lateral condyle of the femur and the intercondyler area had intact differentiated cruciate and menisco- femoral ligaments MFL .The upper surface of the tibial condyles of the knee joint were in articulation with the condyles of the lower ends of the femur .The capsule surround the knee joint (Fig. (E-1). The anterior cruciate ligament ACL had oval attachment to the medial wall of the lateral femoral condyle in the

posterior aspect and the tibial attachment was in the middle of the intercondyler Fig. (E-2)

Morphological examination of a left adult Human knee joint anterior aspect in full flexion showed the thick strong well developed fibrous bands of anterior cruciate and posterior cruciate ligaments (Fig.F).

A collective photograph of stages of the developing PRENATAL intra articular septum and differentiation of the anterior ACL and posterior cruciate PCL as well as the menisco femoral MFL ligaments from the intra articular septum from ages 3,4,5,6.7.8 months fetus till full term. A collective photograph of developing steps of stages (Fig G&G1) compared to well develop ligaments of the adult human knee (Figs. G &G1)

B- Histologic results:

General architecture of anterior cruciate ligament ACL: and its cruciate primordium

B- Histologic results:

General architecture of anterior cruciate ligament ACL: and its cruciate primordium

Histological examination of parts of LS of serial sections of parts of the intra-articular septum (cruciate primordium) of cruciate ligament of 5 months old fetus :(17 - 20weeks) CRL 15-19cm. stained with Masson trichrome showed that cruciate ligament primordium consisted of short thick and thin collagen bundles loosely packed. . Many big oval fibroblasts and spindle shaped fibrocytes were seen among the collagen. Very thin short and long collagen fibers were seen among the short thick collagen bundles (Fig. 1).

Histological examination of parts of LS of serial sections of parts of anterior cruciate ligament ACL of full term (33-36 weeks) CRL 31-34cm). stained by Masson trichrome showed the presence of long thin closely packed collagen bundles arranged parallel and branched occasionally and re-united . Some radially arranged thin collagen bundles were seen. Few spindle shaped fibrocyte were between the collagen bundles (Fig. 2)

Histological examination of parts of LS of serial sections of parts of anterior cruciate ligament ACL of adult human stained by Toluidine blue showed metachromatic reaction of the tissues . Oval-shaped cells surrounded by a metachromatic extracellular matrix ECM laid between the longitudinal collagen fibrils were noted (Fig. 3).

The collagen bundles stained blue Deep purples while the extra cellular matrix ECM in some areas stained pink. Wavy thick branched collagen bundles and thin fibrils in between them were seen.

Histological examination of parts of LS of serial sections of parts of anterior cruciate ligament ACL of adult human stained by H&E showed the long wavy thick and thin closely packed collagen bundles arranged parallel ,and branched then reunited. Very thin collagen fibers run among the collagen bundles Fibroblasts and fibrocytes arranged in rows intermingled among the collagen bundles were noted (Fig. 4)

Histological examination of parts of LS of serial sections of parts of anterior cruciate ligament ACL of adult human stained by H&E Fig (5) at the extreme part near the insertion of the ligament showed the fibrocartilage nous appearance of the tissue ..Excess wavy thick branched collagen bundles and the big oval cells similar fibroblasts (similar to cartilage cells) were embedded between the collagen.Thin fibrils between the thick branched collagen bundles. The single cartilage cells lied in rows between the collagenous bundles, but sometimes two cells were seen inside a capsule

Neuro-receptors: illustrated by Gordon and Sweet Silver impregnation

Histological examination of serial sections of parts of LS of anterior cruciate ligament ACL of full term human fetus:(33-36 weeks) CRL 31-34cm) stained by Gordon and Sweet Silver impregnation, Figs(6-10)showed the presence of spiral structure and Small spindle like structure Fig (6) with one axon , structure with zigzag encapsulated nerve ending in Meissener like corpuscle , free nerve endings, Figs.(6&7), Golgi like organ Fig.(6) and structure similar to flower and part of Pacinian corpuscle with darkly stained lamellae around central white core were noted .Fig.(7)

Histological examination of serial sections of parts of anterior cruciate ligament ACL of full term human:(33-36 weeks) CRL 31-34cm) stained by Gordon and Sweet Silver impregnation, showed spray like structure and nerve bundles were arranged in one row before and behind the spray structure (Figs. 8&10). The spray like neuronal end structure was close to a varicosity large end structure (Fig. 10) single row OR CHAIN of nerve fibers were extended beyond the capsule of the spray structure at each end.

Many large single Pacinian corpuscles were seen as broom like darkly stained, Fig (8) and onion like Fig. (9) darkly stained, with flat lamellate cells ,and the endoneurium was continuous with the capsule of Pacini corpuscle. Large single onion like Pacinian corpuscle, with the connective tissue capsule continuous with the endoneurum was noted. The core of the Pacinian corpuscle was formed of naked axon (Fig. 9)

Figs (7&9) free nerve endings FNE were noted.

Oval elongated single big structure similar to Golgi tendon organ near the Pacinian corpuscle and Raffini corpuscle was seen (Fig. 9).

Ruffini like endings displayed dendritic ramifications with expanded terminal axon and

terminal buttons ends. The terminal or lamellar Schwann cells associated the Raffini corpuscle like ending .Finger-like projections called axonal spines or micro spikes, which extend into the surrounding (Fig. 10)

Ruffini-type corpuscles had branched axon terminals with varicosities under the incomplete capsule. Axons, which were surrounded by thin Schwann cell processes, were embedded in the dense layers of collagen fibrils. The interior of the corpuscle was separated into small compartments by cell processes extended from the capsule, elongated single darkly stained structure similar to Golgi-like organ Fig. (10) Big

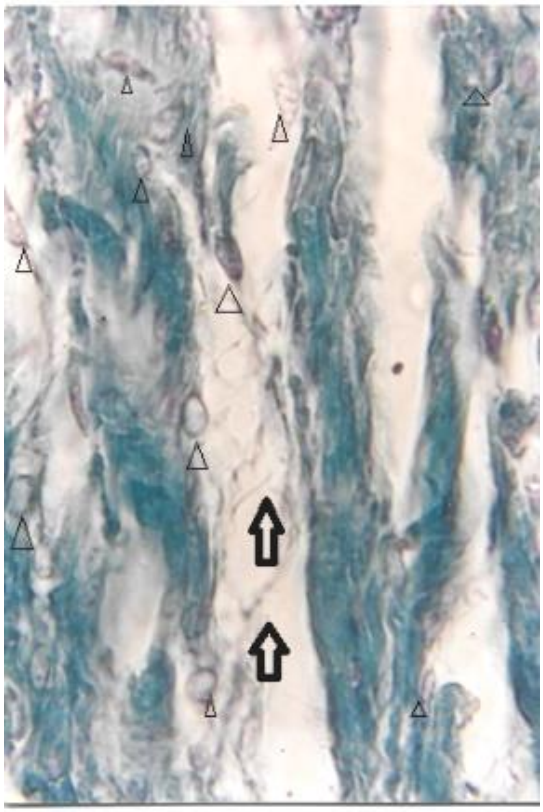

Fig (1): Photomicrograph of LS of part of intra-articular septum (cruciate primordium) of 5 months old fetus :(17 -20weeks) CRL 15-19cm. Showing short collagen bundles loosely packed. . Note the fibroblasts, big oval and spindle shaped cells seen among the collagen (arrow head). Note the Very thin collagen fibers are seen among the short thick collagen bundles(arrow). Masson trichromeX400.

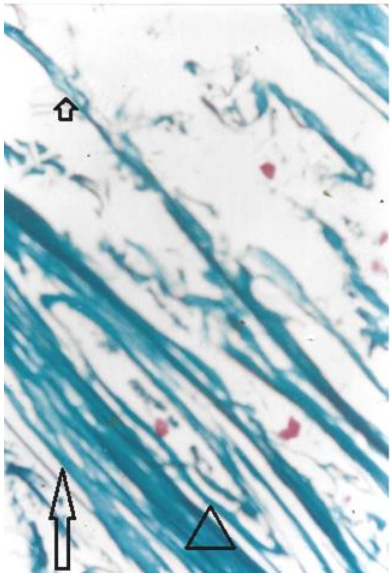

Fig.(2): Photomicrograph of LS of part of anterior cruciate ligament of full term :(33-36 weeks) CRL 31-34cm).showing long thin closely packed collagen bundles arranged parallel and branched occasionally and reunited (long arrow). Few spindle shaped fibroblasts are between collagen bundles (small arrow). Note the radially arranged thin collagen bundles seen (headarrow).Masson trichromeX400

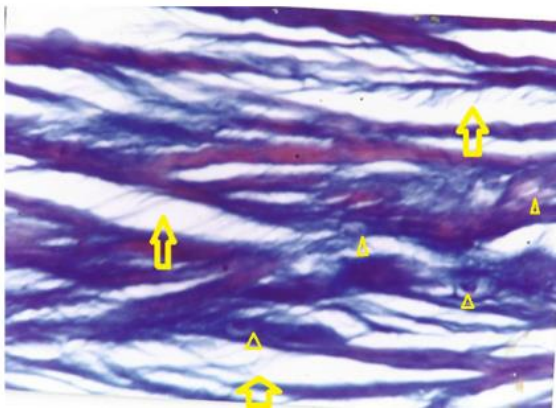

Fig .(3): Photomicrograph of LS of part of anterior cruciate ligament ACL of of full term :(33-36 weeks) CRL 31-34cm human showing metachromatic reaction of the tissues . Note the Oval-shaped cells surrounded by a metachromatic extracellular matrix ECM laid between the longitudinal collagen fibrils. (Head arrow). Note the collagen bundles stained blue while the extra cellar matrix ECM in some areas stained pink.
Note the wavy thick branched collagen bundles (o) and the presence of thin fibrils in between them.(arrow). The long collagen bundles constantly branched and united to form network. Toluidine blue x1000

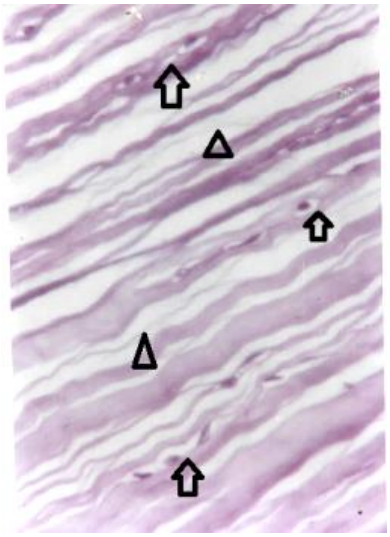

Fig.(4): Photomicrograph of LS of part of anterior cruciate ACL ligament of adult human showing long parallel wavy thick and thin closely packed collagen bundles branched then re-united . Very thin collagen (head arrow) fibers run among the collagen bundles Fibroblasts and fibrocytes (arrow) arranged in rows are noted intermingled among the collagen bundles.
H&ExX400

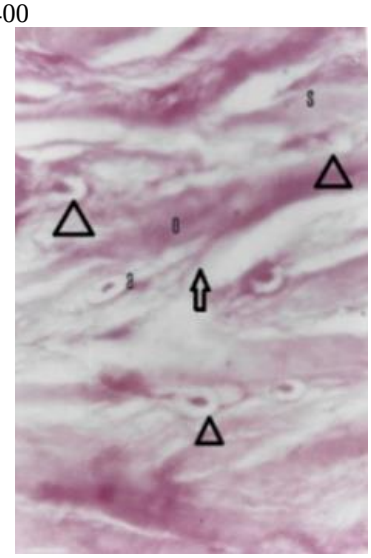

Fig (5): Photomicrograph of LS of part of anterior cruciate ligament of adult human at the extreme part near the insertion of the ligament showing the fibrocartilage nous appearance of the tissue.
Note the excesswavy t thick branched collagen bundles and the big fibroblasts which simulate cartilage cells (a)and fibrocytes and fibroblasts(s) embedded between the collagen(o).
Note the thin fibrils (Arrow between the thick branched collagen bundles (o).
The cartilage cells lie in rows between the collagenous bundles, single but sometimes two cells are seen inside a capsule. (Head arrow).H&Ex1000

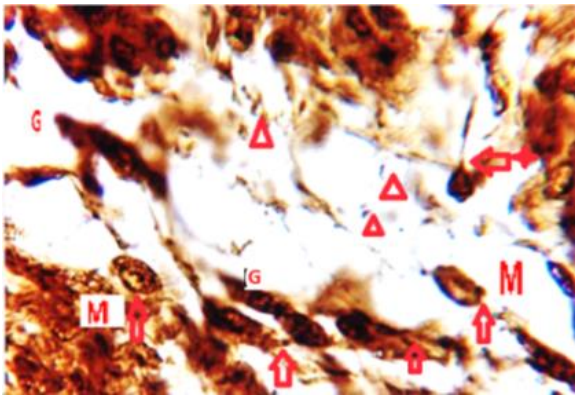

Fig. (6): Photomicrograph of part of TS of part of anterior cruciate ligament of full term human:(33-36 weeks) CRL 31-34cm): showing fusiform structure (arow-star). Note the numerous spiral and zigzag encapsulated nerve ending in Meissener like corpuscle. (Marrow) free nerve endings (arrowhead). Note the Golgi like organ (G). Gordon and Sweet Silver impregnation x1000.

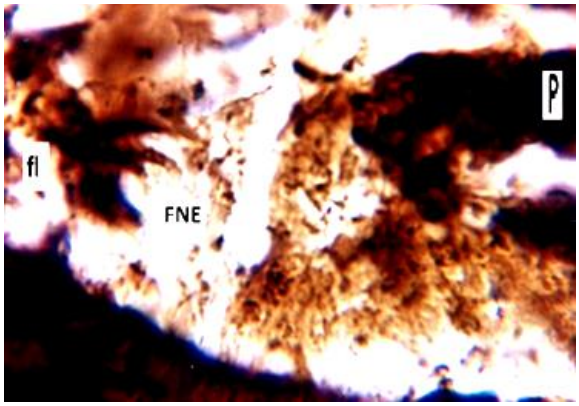

Fig.(7): Photomicrograph of part of TS of part of anterior cruciate ligament of full term human:(33-36 weeks) showing Free nerve endings)(FN and strange structure similar to flower (fl). Note the appearance of part of Pacinian corpuscle with central core and darkly stained lamellea (P). Gordon and Sweet Silver impregnation x1000.

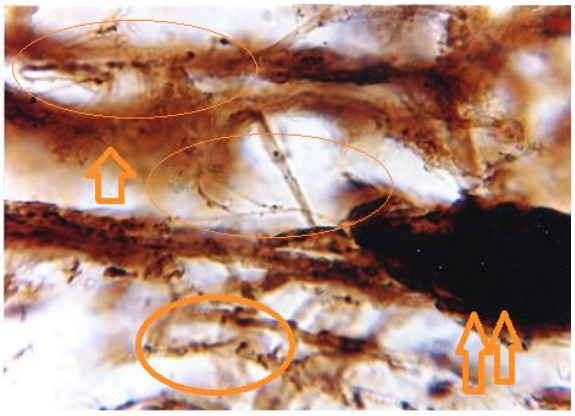

Fig. (8): Photomicrograph of part of TS of part of anterior cruciate ligament ACL of full term human: (33-36 weeks) CRL 31-34cm): showing spray like structure (arrow). Notice the nerves are arranged in one row before and behind the spray structure. Note the bundles of nerves and plexus (circle). Notice the Pacini corpuscle is large and broom like (double arrow) with flat lamellate cells. Notice: that the endoneurium is continuous with the capsule of Pacini corpuscle. Gordon and Sweet Silver impregnation x1000

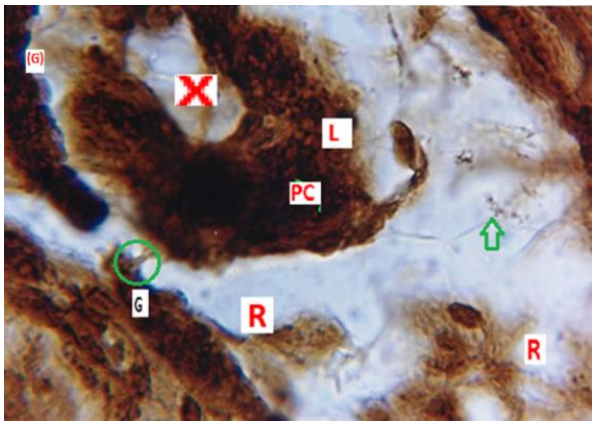

Fig (9): Photomicrograph of part of TS of part of the anterior cruciate ligament of full term human :(33-36 weeks) CRL 31-34cm): showing large onion like Pacinian corpuscle (PC), the connective tissue capsule is continuous with the endoneurum. Note the lamellae (L) forming the Pacinian corpuscle and the core is formed of naked axon.(X). Note the two Raffini ending nerve receptors (R)). Ruffini endings display dendritic ramifications with expanded terminal buttons. Note the free nerve endings (arrow). Note the oval elongated structure similar to Golgi tendon organ (G) closely very near Pacinian corpuscle and Raffini corpuscle with connecting extensions as if communicating. (circle). Gordon and Sweet Silver impregnation x1000.

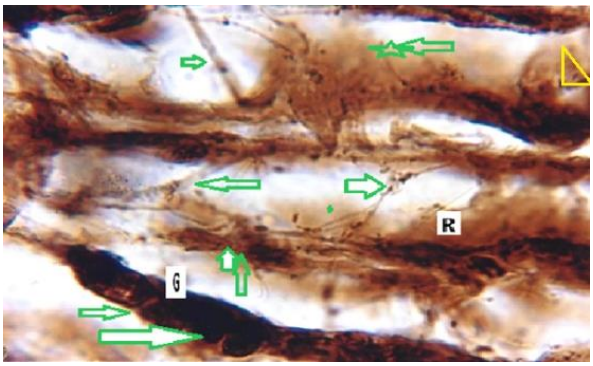

Fig (10): Photomicrograph of part of TS of part of the anterior cruciate ligament ACLof full term human:(33-36 weeks) CRL 31-34cm): showing spray like neuronal end structure (star-arrow) and the varicosity large end structure (yellow head arrow) .Note SINGLE row OR CHAIN of nerve fibers are extended beyond the capsule at each end.

Note the row of nerves bundles communicating as plexus (empty arrow)and with Raffini –like ends (R). Note the small spindle like structure (double arrows: white &empty) . Ruffini like endings displays dendritic ramifications with expanded terminal axon (R) and terminal buttons ends. Note the terminal or lamellar Schwann cells associate the Raffini corpuscle like ending (R) .finger-like projections called axonal spines or micro spikes, which extend into the surrounding
Ruffini-type corpuscles, has branched axon terminals with varicosities under the incomplete capsule. Axons, which are surrounded by thin Schwann cell processes, are embedded in the dense layers of collagen fibrils. The interior of the corpuscle is separated into small compartments by cell processes extended from the capsule tissue.
Note the large oval elongated single darkly stained structure similar to Golgi-like organ)G) (big thin long white arrow). Gordon and Sweet Silver impregnation x1000.

Table (1): Summary of the Morphological Changes occurring in the intra articular septum in the prenatal human developing knee joint till emerging of the cruciate and meniscofemoral ligaments.

Age of fetus	months	4,5 months	6,7months	8months	Full term
Intraarticular septum in the prenatal developing knee joint cavity	Broad septum	Broad septum not uniform in thickness with	Broad septum	Broad septum with pits, foramina and thickened areas	Complete differentiation of cruciate and meniscofemoral ligaments` and Absorption of the septum
Pits and foramina in the septum		Pits and foramina in the medial and lateral sides of the septum increased with age progress	Additional pits in the upper part of the septum	Larger than previous ages	Larger than previous ages differentiation of cruciate and meniscofemoral ligaments`
Broadness of the developing intra-articular septum		Decreased broadness of the septum	Decreased broadness of the septum	Decreased broadness of the septum more than the previous age	differentiation of cruciate and meniscofemoral ligaments` and Absorption of the septum
Thickened round areas and bands in the developing intra-articular septum		Tiny round thickened areas		Increase in size, number , prominence and differentiation of the round thickened areas and bands	Complete differentiation of cruciate and meniscofemoral ligaments` and Absorption of the septum

Table (2): Summary of the histological Changes occurring in the septum (ACLprimordium) and anterior cruciate ACL in the prenatal and the adult human

Age	5months fetus	Full term	ACL of adult	Adult ACL at attachment
collagen	Short straight parallel loosely packed collagen bundles with fibrils' in between them	Long wavy parallel closely packed , branched collagen bundles with thin fine fibrils in between them	Long wavy parallel closely packed, collagen branched bundles forming network with thin fine fibrils in between them. Some radial bundles were seen	Very thick Long wavy parallel closely packed, collagen branched bundles forming network with thin fine fibrils in between them.
Cells between the collagen	Fibroblasts fibrocytes few	fibrocytes Fibroblasts	round cells	cartilage cell

Discussion:

In the present study, the developing prenatal human anterior cruciate ligament ACL was chosen to be studied because the adult was the most frequent injured ligament in the body .The ACL was isometric, i.e the distance between attachments did not vary during knee motion and positions, so its ruptures were more than posterior cruciate PCL ligament, which was not isometric.

That was in accordance to Standring et al. (2016) who mentioned that the PCL unlike the anterior cruciate ligament ACL, it was not isometric during knee motion, i.e the distance between attachment varied with knee position .The posterior cruciate ligament PCL ruptured less commonly than the anterior cruciate ACL ligament and ruptures were better tolerated by patients than ruptures of the anterior cruciate ligament ACL.

That also agreed with Wineski 2019 who pointed that the ruptured cruciate ligament ACL was more common in women, that might be due to different alignment of the thigh on the leg in women associated with wider pelvis. There was also increased risk in women during the pre -ovulatory phase of the menstrual cycle, possibly due to the influence of the female sex hormones.

The ACL cruciate ligament and other knee intra articular structures were chosen to be studied in the present work to explore the creation of Allah according to suret alالذاريات thareat 21 suret,Lukman لقمان11 & suret Fusilateفصلت53

In the present work the ages of the fetuses collected after spontaneous abortion with no maceration, or external abnormality, were estimated according to tables of Sadler (2012) and Sadler (2019) depending on calculating the first day of the last menstrual period of the mother (LMP).

However, Standring et al. (2016) mentioned that the absolute size of an embryo or fetus did not afford a reliable indication of either its chronological age of the stage of the structural organization, even though graphs based on large numbers of observations. Had been constructed to provide averages. All such data suffered the difficulty of timing and the moment of conception in humans. It had long been customary to compute the age, whether in normal birth or in abortion, from the first day of the last menstrual period of the mother, but as ovulation usually occurred near the fourteenth day of menstrual cycle that "menstrual age" was over estimated of about two weeks. Where a single coitus could be held to be responsible for conception, a "coital age" could be estimated and a "fertilization age" could not be much less than the difference might be several days, which was a highly significant interval in the earlier stages of embryonic development .Even in the time of ovulation and coitus were known in instance of spontaneous abortion, not only would some uncertainty still persist with regard to the time of fertilization, but also there would remain an indefinable period between the cessation of development and the actual recovery of the conceptus.

Standring et al. (2016) reported that the development of a human from , fertilization to birth was divided into two periods embryonic and fetal .The embryonic period had been defined by Streeter as 8weeks post fertilization, or 56days.That time scale was divided into 23 Carnegic stages ,a term introduced by O·Rahilly and Muller (1987) to replace developmental "horizons".The designation of stage was based on external and internal morphological criteria and not on length or age .

However, Standring et al. (2016) pointed that ,where the development staging throughout their text was juxtaposed with obstetric estimation of gestation that was used clinically .A critique of staging terminology and the hazards of concurrent use of gestation age and embryonic age was given according to sizes and ages of the fetuses towards the end of gestation.

A-Morphogenesis

In the present study morphological examination of the knee joint of 3 months fetus (12-13wks-CRL 8-9cm) and 4 months old fetus(13-16wks-CRL 9-14cm) showed that a middle intra -articular broad septum was detected in the joint cavity, separating the joint cavity into medial and lateral parts. Two condylar joints were resulted between the medial and lateral condyles of the femur and the corresponding condyles of the tibia. The septum was not uniform in thickening at the age of 4 months fetus (which represented the cruciate ligaments premordium).

At 5months aged fetus ,the cruciate ligaments premordium present as an intra-articular septum having tiny thickened round areas(colliculi),which increased in size , thickening, number and prominence with age progress. At the age of 8 month fetus the intra -articular septum decreased in broadness, and the thickened round areas and bands increased in size , thickening, number and prominence in the middle of that septum with age progress, till emerging of anterior and posteripr cruciate ligaments ACL and PCL.besides meniscofemoral MFL. Ligament at full term fetus. These thickened areas in the intra-articular septum might be the precursors of the future different functional tissue bands of ACL and PCL and MFL. However the functional bands forming the ACL and PCL were also subjects of debate. At full term fetus, the septum was absorbed and differentiated to ACL, PCL cruciate and both or one of anterior and posterior meniscofemoral ligaments aMFL pMFL was noted.

The results of the present work agreed with Doskoil (1984), who studied the human knee joint during the period in which the joint gap developed. He found that the knee joint contained a high broad septum which he called (The mediastinum genus) in which there were many blood vessels. Those vessels fed the cruciate ligaments analogs, the meniscus analogs , the cartilaginous and the adjacent bone analogs .In the human embryo the mediastinum genus had splitted the knee joint into a lateral and a medial halves. Communication between these two halves was between the small contact surface of the patella and femur analogs.However, further differentiation of that mediastinum genus had not reported sufficiently in the literature.

The results of the present work agreed with the previous work of Abd elwahab et al. (2018) who found an intra articular septum in human knee joint cavity in the prenatal developing 3months aged fetus. Abd

elwahab et al. (2018) followed that the developing of the intra articular septum from 3months aged fetus till full term, when the septum was differentiated into cruciate and meniscofemoral ligaments. They also traced some other extra synovia l knee joint ligaments. Abd elwahab et al. (2018) studied and published some morphological and histological prenatal studies on some structures of the developing human knee joint, and compared with the adult human knee joint.

The results of the present work coincided with Fredich et al. (1992) who found evidence supporting the two-bundle and three bundle theories of cruciate ligament fiber patterns after studding the functional anatomy of the knee joint of 130 fresh frozen adult cadavers.

The results of the present study was in accordance with Dodds and Arnoczky (1994) who announced that the anterior cruciate ligament was a complex, structure with biology, construction, and orientation, that related to its function as a constraint of knee motion, meanwhile the complexity of its design allowed the ligament to function through the normal range of movement as a static stabilizer of the knee, it also made the exact duplication of that structure very difficult in surgical treatment.

The results of the present work agreed with Petersen and Tillmann (2002) who mentioned that the anterior cruciate ligament ACL of adult consisted of multiple small fiber bundles ,from a functional point of view, anteromedial and the posterolateral fiber bundles could be differentiate , the anteromedial fibers were tense during a greater range of motion than the posterolateral fibers.

However Standring et al. (2016) added one more functional band in anterior cruciate ligaments ACL more than what Petersen and Tillmann (2002) previously mentioned. Standring et al. (2016) mentioned the intermediate fiber bands and mentioned 3 three functional bands: not only two as Petersen and Tilman (2002). Standring et al. (2016) mentioned that the average length and width of adult anterior cruciate ligaments were 38mm and 11mm, respectively. It was formed of two or possibly three functional bands that were not apparent to the naked eye but could be demonstrated by micro-dissection techniques. The bundles were named antero medial, intermediate and posterolateral, according to their tibial attachment.

In spite of, the present study was about anterior cruciate ligaments ACL, it was` worth comparing ACL with posterior cruciate ligaments, which also emerged from the intra-articular septum (many rounded thickened areas) in the prenatal developing human knee joint. The posterior cruciate ligament PCL had two functional bands as mentioned by Standring et al. (2016) who reported that the posterior cruciate ligament PCL was thicker and stronger than the anterior cruciate ligament ACL. The average length and width of a PCL of adult were 38mm and 13mm; respectively. It was attached to the lateral surface of the medial femoral condyle and extended up on to the anterior part of the root of the intercondylar fossa. Anterolateral and posteromedial bundles had been identified; they were named (against convention) according to their femoral attachment. The anterolateral bundle tightened in flexion while the posteromedial bundle was tight in extension of the knee. Each bundles slackened as the other tighten. Unlike the anterior cruciate ligament, it was not isometric during knee motion, i.e the distance between attachments varied with knee position. The posterior cruciate ligament ruptured less commonly than the anterior cruciate ligament and rupture was usually better tolerated by patients than rupture of the anterior cruciate ligament.

In the present work the anterior cruciate ligament ACL of full term infant (37-38 weeks) CRL 35-36cm) was attached to the posteromedial aspect of the lateral condyle and the tibial attachment was in the anterior intercondyler area .That agreed with(Girgiset al., 1975).cited in Standringet al., 2016 who mentioned that the anterior cruciate ligament was attached to the anterior intercondylar area of the tibia just anterior and slightly lateral to the medial intercondylar tubercle ,partly blending posterolaterally ,twisting on itself and fanning out to attach high on the posteromedial aspect of the lateral condyle.

In the present work the posterior cruciate ligament PCL of full term infant (37-38 weeks) CRL 35-36cm) was attached to the lateral surface of the medial femoral condyle and extended up on to the anterior part of the root of the intercondylar fossa,. That agreed with Standringet al. (2016) who mentioned that the posterior cruciate ligament PCL of adult at its attachment was extensive in the anteroposterior direction; its fibers were adjacent to the articular surface. They passed distally and posteriorly to a fairly compact attachment posteriorly in the intercondylar region and in a depression on the adjacent posterior tibia, that gave a fan like structure in which fiber orientation was variable.

In the present work , stages of differentiation of the intra-articular septum of the prenatal fetuses (septum genu) till the emerging of anterior cruciate ACL,posterior cruciate PCL ligaments and meniscofemoral MFL ligaments from that septum was noted with age progress from 3 ,4,5,6,7,8,months, aged fetuses till full term and new born infant. The morphological and histological changes in that intra articular septum occurred in chronologic successive consequent steps and *stages*, one stage after another; step after step till the emerging of the cruciate and meniscofemoral ligaments. The emerging of the ligaments from the intra-articular septum of the

prenatal developing human knee joint in successive consequent stages and steps was mentioned in The Quraan .suret alالزمر zomar6 and suret NOOHk نوح 14

• Creation after creation- suret al zomar6, and stages: atwara in the Arabic language of the Quraan the holy book of Muslims. تفسير السعدي سورة خلقكم أطوارا14 – نوح: خلقا من بعد خلق في بطن الأم ثم في الرضاع ثم في سن الطفولة ثم التمييز ثم الشباب ثم الي أخر ما يصل اليه الخلق .فالذي انفرد بالخلق والتدبير البديع متعين أن ينفرد بالعبادة والتوحيد ,و في ذكر ابتداء الخلق تنبيه لهم غلي المعاد ,وأن الذي أنشأهم من العدم قادر غلي أن يعيدهم بغد موتهم. تفسير السعدي للقرآن تيسير الكريم الرحمن في تفسير كلام المنان

• In the present work , the morphological examination The anterior aMFL ligament of HUMPHREY and pMFL posterior menisco femoral ligaments of Wrisbergs showed that they were thick cord like bands as secondary supports for the posterior cruciate ligament and the knee joint.. That was mentioned in suret al Ensane28 (The human) (الانسان that Allah had created the human and supported, strengthened and fortified his joints and organs by supports as in the present study was represented partly by the cruciate ligaments and menisco femoral ligaments.

من حديث أنس رضي الله عنه: كان رسول الله اذانظر في المرأة قال :الحمد لله الذي سوي خلقي فعدله :الحديث أخرجه الطبراني في الاوسط- ذكره الشوكاني في كتاب تحفة الذاكرين بعدة الحصن الحصين رقم316 في فصل الرؤية

Thanks to Allah(God) who made my creation and made it straight. The middle Moegam (index).

Narrated after Anas: present in collection of zawaed.

In the present work , the histological examination by light microscope using different stains showed that the changes occurred in the prenatal developing ACL were as follows :At the age of 5months fetus ,the ACL was formed of loosely packed short parallel collagen bundles and fine thin fibrils in between the collagen bundles. In addition to intermingle big fibroblasts .At full term. the collagen bundles were long wavy closely packed branched forming net work , thin fibrils in between the collagen bundles were present ,besides intermingling fibrocytes between the collagen bundles .The audlt ACL, had thick collagen bundles very thick compact wavy closely packed,and very thin fibrils in between the thick collagen bundles were noted. Big oval cells between the collagen bundles were found all over the ACL ligament .At the ACL (TIBIAL) attachment, the tissue of ACL ligament showed the appearance of fibrocartilage tissue .The change in the histology of ACL at its tibial attachment was to provide more strength and fortification of the ligament to support the knee joint ant its function functions as in suert al ensane28. The changes in ACL from weakness to strength situation was also mentioned in Suret al haj الحج5 and suret alالروم Room(The Roman)54 .And from creation to another creation suret al سورة المؤمنون: خلقا آخرmoemenoon14 (Kalkan akr).(That was also meant in the Quraan by the word ASHODأشدكم: STRNGTH and was explained by the reaching the age of 18 years or 33 years or 40 years ,as mentioned in the Book of Galalyeen in the explanation of the meanings of QURAN.the holy book of Muslims)

That results of the present work agreed with Quran, as the morphological and histological changes occurred in stages :steps after steps;creation after creation were mentioned in suret Nooh11(Atwara) which meant in the emgeryonic medical language stages in the Quran and suret (Kalkan baed kalk) creation after creation . Suret Al zomar 6and Suret AL enfetar 7 kalakak, Sawak,adalak. However THE explanatiom of Quran by the Galaleem mentioned that atwara, and creation after creation, were represented by the stages of notfa, alka, modga that were mentioned in suret al moemenoon14. Which corresponded in the medical embryonic language as stage of sperms, blastocyst, and trilaminar embyo stage.However the apparent morphological and histological changes in intra articular septum in the developing prenatal human keen joint till the emerging of the ligaments from that septum in consecutive following stages, then completion of strength in the adult knee in the present work coincided with the Quraan. The morphological and histological changes with age progress might correspond in Quraan to suret AL enfetar 7: kalakak, SAWAK, adalak. Sawa as explained by al Galalyeen the explanation of the meaning of Quraan the completion of the creation

In the present work, at the age of 4and 5 months fetuses, very tiny thickened round areas (were seen after magnification of the photographs by the lab top in the modern techniques) and bands were detected in the intra-articular septum (septum genu), the (anterior cruciate primordium). These thickened round areas and bands increased in size, number, prominence and differentiation with age progress from 4month till 8month, then at full term where the emerging of the menisco-femoral MFL, ACL and PCL cruciate ligaments were noted. At full term the cruciate and MFL ligament emerged from the intra-articular septum and the septum was absorbed. Those many thickened areas and bands, which increased in size, number and prominence with age progress, might be the precursors of the different functional bands in the anterior cruciate ACL and posterior cruciate PCL ligaments and MFL.

The results of the present work agreed with Standringet al. (2016) who mentioned many different functional bands in both adult ACLand PCL cruciate ligaments .They mentioned that the anterior cruciate ACL was formed of two or possibly three functional bands that were not apparent to the naked eye but could be demonstrated by micro dissection techniques, The

bundles were named antero medial, intermediate and posterolateral, according to their tibial attachment. However, Petersen and, Tillmann 2002 mentioned only two functional bands in the ACL.In the posterior cruciate ligament PCL there were anterolateral and posteromedial bundles had been Identified; they were named (against convention) according to their femoral attachment..

In the present study morphological examination of anterior cruciate ligaments ACL of full term fetus and adult showed that it had oval attachment to the medial wall of the lateral femoral condyle in the posterior aspect, and the tibial attachment was just antero lateral to the medial intercondylar tubercle in the middle of the intercondyler area. The posterior cruciate ligament PCL was attached to the lateral surface of the medial femoral condyle and extended up on to the anterior part of the root of the intercondylar fossa, where its attachment was extensive in the anteroposterior direction, its fibers were adjacent to the articular surface. They passed distally and posteriorly to a fairly compact attachment posteriorly in the intercondylar region and in a depression on the adjacent posterior tibia. The results of the present work coincided with many authors who argued the origin and insertion of the anteriorACL, and the posterior cruciate ligamentsPCL. Some authors referred to that as just attachment.

Petersen and Tillmann 2002 mentioned that the anterior cruciate ligament ACL originated at the medial wall of the lateral femoral condyle and inserted into the middle of the intercondyler area. While Wineski 2019 pointed that the anterior cruciate ligament ACL attached to the anterior intercondylar of the tibia and passed upward backward, and laterally to attach to the posterior part of the medial surface of the lateral femoral condyle. The anterior cruciate ligament ACL arose from the anterior intercondylar part of the tibia and extended posterolateraly to the medial aspect of the lateral femoral condyle .Other workers pointed that the cruciate ligaments were strong fibrous bands ,the anterior cruciate ligament ACL and posterior cruciate ligament PCL connected the femur to the tibia .They originated from tubercles located on the tibia and were located between the femoral condyles.The ACL extended upward,posteriorly ,and laterally from the origin of the tibia and inserted into the medial aspect of the lateral femoral condyle.(Grants:5.57-572Netter (led):477-480(2nd):473-4756-Rohen/Yokochi:420-423.

Standring et al. (2016) mentioned that the anterior cruciate ligament was attached to the anterior inter-condylar area of the tibia just anterior and slightly lateral to the medial inter-condylar tubercle, partly blending posterolaterally, twisting on itself and fanning out to attach high on the posteromedial aspect of the lateral condyle (Girgis et al., 1975).

The Meniscofemoral ligament MFL ligaments: anterior (aMFL) and posterior (pMFL)

In the present work differentiation of MFL anterior(aMFL) and posterior (pMFL)and emerging from the intra-articular septum of the developing prenatal human knee joint was noted .The anterior meniscofemoral ligament aMFL ligament of HUMPHREY and posterior meniscofemoral ligament pMFL of Wrisbergs ligaments were in relation to posterior cruciate ligament and the lateral meniscus,which was separated from fibular collateral ligament by the tendon of popliteus that grooved the lateral meniscus posteriorly.

The results of the present study agreed with Standring et al.(20016) who mentioned that the lateral meniscus was grooved posteriorly by the tendon of popliteus,which separated it from the fibular collateral ligament. Near the lateral meniscus posterior attachment it commonly sent a posterior meniscofemoral ligament superiorly behind the posterior cruciate ligament to the medial femoral condyle, an anterior meniscofemoral ligament might also connect the posterior horn of the lateral meniscus to the medial femoral condyle anterior to the posterior cruciate ligament. The meniscofemoral ligaments were often the sole attachment of the posterior horn of the lateral meniscus.

In the present work differentiation of the cruciate ligaments and meniscofemoral ligaments MFL was noted in full term from the intra-articular septum in the joint cavity of the developing prenatal human knee. However Meniscofemoral ligament MFL ligaments anterior a MFL and posterior pMFL were noted in some fetuses, other fetuses had only posterior p MFL. The menisco femoral ligaments.MFLs were thought to interfere with knee kinematics, fixing the knee joint and function as secondary supports for the lateral meniscus and posterior cruciate ligament. Therefore, the MFL might be one cause to explain why the lesions, ruptures and tears of the lateral meniscus and the posterior cruciate ligament PCL were less than the medial meniscus and anterior cruciate ligaments ACL.

The results of the present study agreed with Gilroy 2013 and Standring et al. (20016)

Gilroy 2013 mentioned that the meniscofemoral ligament (MFL) joined the lateral meniscus to the posterior cruciate ligament and medial femoral condyle. Standring et al. (20016) pointed that the meniscofemoral ligaments (MFLs) connected the posterior horn of the lateral meniscus to the inner (lateral) aspect of' the medial femoral condyle. The anterior MFL) (a MFL; ligament of HUMPHREY) passed anterior to the posterior cruciate ligament. The posterior meniscofemoral ligament p MFL (pMFL; ligament of Wrisberg) passed behind the posterior cruciate ligament and attached proximal to the margin

of attachment the posterior cruciate ligament. Anatomical studies found that at least one meniscofemoral ligament was present in in 92%~of Cadaveric knees examined, whilst both-coexisted 32%. Biomechanical studies had revealed that the ligaments sectional area and strength of the meniscofemoral ligaments were comparable to those of the posterior fiber bundle of the posterior (cruciate) PCL ligament .The meniscofemoral ligaments were believed to act as secondary strains, supporting the posterior cruciate ligament in minimizing displacement caused by directed forces on the tibia. Those ligaments were also involved- in controlling the motion of the lateral meniscus in conjunction with the tendon of popliteus during flexion.

The presence of both MFL or only one in the human knee joint :anterior) (a MFL;ligament of Humphrey) and posterior pMFL; ligament of Wrisberg) meniscofemoral MFLs agreed with what had previously mentioned in Quran the Holy book of muslims suret al Omran 6يصوركم في الأرحام كيف يشاء سورة آل عمران

That Meant: Allah (the most mercifull the most gracefull). He Who (created-photo pictured you in the uteri(whom) as He wishes. suret aal Omran 6

The presence of both MFL or only one in the human knee joint .ALSO agreed with what had previously mentioned in Quran the Holy book of Muslims- suret al Haj 5 :Modga mokalaka or not mokalaka:مضغة مخلقة وغير مخلقة

Modga :(meant in the embryonic language: the stage of trigerminal -The Tri laminar germ disk) Created or not created-suret -Al haj-5 (suret - pilgrimage)

The menisco femoral ligaments.MFLs were thought to function as secondary supports and leavers for the posterior cruciate ligament, to help the knee joint functions. That was what mentioned in suret al Ensane(2828 سورة الأنسان 0that Allah had created the human and supported, strengthened and fortified his joints and organs by supports,which was represented in the present study PARTLY by the cruciate and MFL ligaments.(another supports were the extra capsular knee joint ligaments and the synovial capsule)

. تفسير الجلالين للقرآن :سورة الأنسان 28خلقناهم وشددنا أسرهم : شددنا :قوينا, أسرهم: أعضاءهم ومفاصلهم

Suret Al thareate (21) - Dont you observe your self-creation? 21 الذاريات وفي أنفسكم افلا تبصرون؟

In the present work in the ages of 5months fetus till 8month fetus, multiple thickened round areas and bands were found in the developing intra-articular septum .These thickened areas and bands increased in prominent with age progress till complete differentiation into cruciate ligaments and menisco femoral ligament ,and absorption of the septum at full term.These multiple thickened round areas and bands might be the precursors of the different functional bands in the ACL, PCL ,and MFL ligaments which were necessary to prevent separation of femur from tibia in the multiple directional movements of the knee joint.

.الحمد لله

- هذا خلق الله فأروني ماذا خلق الذين من دونه : سورة لقمان آية الحمد لله تفسير الجلالين :سورة الأنسان 28خلقناهم وشددنا أسرهم : شددنا :قوينا أسرهم : أعضاءهم ومفاصلهم
- ورد في كتاب الشوكاني:كتاب تحفة الذاكرين بعدة الحصن الحصين: حديث الرسول النبي الأمي بسنده رقم (311): الحمد لله الذي سوي خلقي فعدله (المعجم الأوسط) . من حديث أنس رضي الله عنه قال :كان رسول الله صلي الله عليه وسلم اذا نظر وجهه في المرآه قال: الحمد لله الذي سوي خلقي فعدله ,وصور صورة خلقي فأحسنها ,وجعلني من المسلمين .قاله في مجمع الزوائد, وفيه هاشم بن عيسي لم أعرفه وبقية رجاله ثقات 11

Meaning of the ayah. Lukman سورة لقمان11: That is what Allah had created Show us what others inferior to him had created.

In the present work differentiation of the cruciate ligaments and meniscofemoral ligaments and their emergence from the intra-articular prenatal developing (septum genus) of the human knee joint was noted, consecutive stages in steps. Differentiation of the established ligaments and emergence of another tissue different from the initial mesnchymal tissue of the intraarticular septum, (septum genus).That agreed with suret Al moemenoon(The believers- The faithful people) 14: another creation other than the former creation(kalkan akar) . خلقا آخر However ,Al galaleen explanation of Quraan mentioned that خلقا آخر kalkan akr meant the blow of spirit (al rooh)نفخ الروح

آخر

- يقابل به الأول، وآخر يقابل به الواحد، ويعبر بالدار الآخرة عن النشأة الثانية، كما يعبر بالدار الدنيا عن النشأة الأولى نحو: {وإن الدار الآخرة لهي الحيوان} [العنكبوت/64]، وربما ترك ذكر الدار نحو قوله تعالى: {أولئك الذين ليس لهم في الآخرة إلا النار} [هود/16].

وقد توصف الدار بالآخرة تارة، وتضاف إليها تارة نحو قوله تعالى: {وللدار الآخرة خير للذين يتقون} [الأنعام/32] {ولدار الآخرة خير للذين اتقوا} (في المخطوطة: {ولأجر الآخرة أكبر لو كانوا يعلمون} [النحل/41]. ولا شاهد فيها) [يوسف/109].

وتقدير الإضافة: دار الحياة الآخرة.

و (أخر) معدول عن تقدير ما فيه الألف واللام، وليس له نظير في كلامهم، فإن أفعل من كذا؛

- إما أن يذكر معه (من) لفظا أو تقديرا، فلا يثنى ولا يجمع ولا يؤنث.
- وإما أن يحذف منه (من) فيدخل عليه الألف واللام فيثنى ويجمع.

وهذه اللفظة من بين أخواتها جوز فيها ذلك من غير الألف واللام.

والتأخير مقابل للتقديم، قال تعالى: {بما قدم وأخر} [القيامة/13]، {ما تقدم من ذنبك وما تأخر} [الفتح/2]، {إنما يؤخرهم ليوم تشخص فيه الأبصار} [إبراهيم/42]، {ربنا أخرنا إلى أجل قريب} [إبراهيم/44].

وبعثه بأخرة. أي: بتأخير أجل، كقوله: بنظرة.

وقولهم: أبعد الله الأخر أي: المتأخر عن الفضيلة وعن تحري الحق (يقال في الشتم: أبعد الله الأخر بكسر الخاء وقصر الألف، ولا تقوله للأنثى، وقال ابن شميل: الأخر: المؤخر المطروح

In the present study .transformation of the anterior cruciate ligament of adult at the site of attachment to tibia from ,had differed from all the ACL tissue and became fibro cartilaginous instead of collagenous tissue ,was noted in the human knee joint; .That kom agreed with Suret al Haj 5 Ashoda
فإنا خلقن اكم من تراب ثم من نطفة ثم من علقة ثم من مضغة ..... نخرجكم طفلا ثم لتبلغوا أشدكم الكمال والقوة:
Ashod kom: Galaleen explanation of the Quraan:
meant the strength and perfection.
Asfanani the meanings of the words of Quran:
Ashod was; the strength.
شد
- الشد: العقد القوي. يقال: شددت الشيء: قويت عقدة، قال الله: {وشددنا أسرهم} [الإنسان/28]، {حتى إذا أثخنتموهم فشدوا الوثاق} [محمد/4]. والشدة تستعمل في العقد، وفي البدن، وفي قوى النفس، وفي العذاب، قال: {وكانوا أشد منهم قوة} [فاطر/44]، {علمه شديد القوى} [النجم/5]، يعني: جبريل عليه السلام، وقال تعالى: {عليها ملائكة غلاظ شداد} [التحريم/6]، وقال: {بأسهم بينهم شديد} [الحشر/14]، {فألقياه في العذاب الشديد} [ق/26]. والشديد والمتشدد: البخيل. قال تعالى: {وإنه لحب الخير لشديد} [العاديات/ 8]. فالشديد يجوز أن يكون بمعنى مفعول، كأنه شد، كما يقال: غل عن الأفضال (انظر: البصائر 302/3، واللسان (غلل) ؛ وعمدة الحفاظ: شد)، وإلى نحو هذا: {وقالت اليهود يد الله مغلولة غلت أيديهم} [المائدة/64]، ويجوز أن يكون بمعنى فاعل، فالمتشدد كأنه شد صرته، وقوله تعالى: {حتى إذا بلغ أشده وبلغ أربعين سنة} [الأحقاف/15]، [ففيه تنبيه أن الإنسان إذا بلغ هذا القدر يتقوى خلقه الذي هو عليه، فلا يكاد يزايله بعد ذلك، وما أحسن ما نبه له الشاعر حيث يقول:
- 260 - إذا المرء وافى الأربعين ولم يكن *** له دون ما يهوى حياء ولا ستر
- 261 - فدعه ولا تنفس عليه الذي مضى *** وإن جر أسباب الحياة له العمر]
(البيتان اختلف في قائلهما، فقيل لمالك بن أسماء، وقيل للأقيشر، وقيل غير ذلك. وهما في البصائر 302/3 دون نسبة؛ والحماسة البصرية 73/2؛ وشرح المقامات للشريشي 16/2؛ والدرب المصون 462/6؛ وأمالي القالي 78/1؛ وسمط اللآلئ 263/1. ويقال: نفست عليه الشيء، أنفسه نفاسة: إذا لم تره أهلا له)] (ما بين قوسين نقله السمين في الدر المصون 462/6)
وشد فلان واشتد: إذا أسرع، يجوز أن يكون من قولهم: شد حزامه للعدو، كما يقال: ألقى ثيابه: إذا طرحه للعدو، وأن يكون من قولهم: اشتدت الريح، قال تعالى: اشتدت به الريح} [إبراهيم/18]. {اشتدت به الري
مختار الصحاح
* ش د د * شيء * شديد * بين الشدة بالكسر وقد * اشتد * و * شد * عضده قواه و * شده * أوثقه يشده ويشده بالضم والكسر * شدا * فيهما وقوله تعالى { حتى يبلغ أشده { أي قوته وهو ما بين ثماني عشرة سنة إلى ثلاثين وهو واحد جاء على بناء الجمع مثل آنك وهو الأسرب لا نظير لهما وقيل هو جمع لا واحد له من لفظه مثل آسال وأبابيل وعباديد ومذاكير وقال سيبويه واحدة * شدة * بالكسر وهو حسن في المعنى لأنه يقال بلغ الغلام شدته ولكن لا تجمع فعلة على أفعل وأما أنعم فإنما هو جمع نعم من

B-Histogenesis:

In the present work histological examination of serial sections of parts of anterior cruciate ligament ACL primordium of 5 months fetus (17 -20weeks) CRL 15-19cm) stained with Masson trichrome showed that the ligament consisted of short collagen bundles loosely packed. . Fibroblasts were seen among the collagen. Very thin collagen fibers were seen among the short thick collagen bundles.

In the present work histological examination of of serial sections of parts of anterior cruciate ligament ACL of full term :(33-36 weeks) CRL 31-34cm, stained with Masson trichrome showed that the ligament consisted of long thin closely packed collagen bundles arranged parallel and branched occasionally and reunited. Fibroblasts were embedded between collagen bundles .Some circularly arrangement of collagen bundles were noted. The radial arrangement of collagen bundles in the ACL of full term might be to strengthen and fortify the ligament against the twisting movement, stress, load and enhance healing of tears. That was similar to the structure in the medial meniscus which had circular arrangement. That was similar and agreed with Peterson and Tillman 1999 who mentioned that the major part of collagen fibres in the central portion of the medial meniscus of the human knee ran in circular arrangement while in the central portion they were parallel as in tendon tissue.

That was also similar to Kummer (1957) who added that the circularly arranged collagen fibres bundles in the inner zone of the medial meniscus could resist circular stresses. That was similar to the results of Abdelwahab et al. (2018) who observed circular collagen bundles orientation in the developing prenatal human fetal medial meniscus and attributed that to accommodate the meniscus to twist, stress and knee kinematics.

In the present histological study of serial sections stained by toluidine blue of parts of anterior cruciate ligament ACL of full term :(33-36 weeks) CRL 31-34cm showed metachromatic reaction of the extracellular matrix tissues. That might be due to the presence of more than one type of collagen with different glycosaminoglycans concentration which stained differently. There were thick branched collagen bundles forming network, and thin fibrils in between them. Oval-shaped cells surrounded by excess collagen were seen.

The results of the present work coincided with Petersen, Tillmann (2002) who found in the adult anterior cruciate ligament ACL, Oval-shaped cells surrounded by a metachromatic extracellular matrix lied between the longitudinal collagen bundles and the thin fibrils. However that was not similar to McNicol and Toughley (1980) who found not apparent metachromatic staining with toluidine blue in the medial meniscus.

The results of the present work agreed with El Rakawy (1971) who mentioned that metachromatic staining occurred when certain cells and tissue were stained by certain type of dye ,the tissue took up a color different from that of the dye employed e.g toluidine blue stained the granules of mast cells reddish violet.

In the present work histological examination of serial sections of parts of LS of adult anterior cruciate ligament ACL stained with H &E showed that, nearly the whole ACL except the extreme parts at ligament at the tibial attachment ,the ligament consisted of long parallel wavy thick closely packed collagen bundles , branched and reunited. Very thin collagen fibers ran among the collagen bundles. Fibroblasts and fibrocytes arranged in rows intermingled among the collagen bundles. At the extreme tibial attachment of the of adult ACL ligament, the ligament differed from all over the ligament tissue and resembled fibrocartilages. There were oval cartilage cells, single cells or sometimes two cells with twin appearance lied in rows among excess long branched wavy thick compact collagen bundles .

In the present histological examination of adult ACL ligament at the tibial attachment showed its change to fibrocartilage, to support, fortfy and strengthen the ACL. That was indication of the powerful creator: ALLAH, the most merciful –suret al thareate -21:سورة الذاريات: وفي أنفسكم أفلا تبصرون Don't you observe your self creation?and suret Fusilate 53 سورةفصلت: We will show them our miracles in the world realm and in them selves ,till the truth is clear to them.

The results of the present work was similar to El Rakawy (1971) who mentioned that white fibrocartilage was a transitional form between typical white fibrous tissue and cartilage .It did not have a pericondrium.It was cartilage contained excess collagenous bundles. The cartilage cells lied in rows between the collagenous bundles, usually single but sometimes two cells might be found inside a capsule .In region when some tendons became inserted into long bones, white fibrocartilage could be seen. Some but not all the tendons changed to white fibrocartilage before they became inserted into long bones.

That result of the present work agreed with Petersen and Tillmann (2002) who mentioned that the anterior cruciate ligament ACL of adult consisted of multiple small fiber bundles. The main part of the anterior cruciate ligament consisted of type 1 collagen positive dense connective tissue. The longitudinal fibrils of type I collagen were divided into small bundles by thin collagen thin type III collagen positive fibrils. In the distal third, the structure of the tissue varied from the typical structure of the ligament. In that region, the structure of the tissue represented fibrocartilage. Oval-shaped cells surrounded by a metachromatic extracellular matrix lied between the longitudinal collagen fibrils. The femoral origin and the tibial inserted had the structure of condral apophyseal enthesis. They detected three avascular areas within the ACL ligament: both cartilaginous entheses of the anterior cruciate ligament were devoid of blood vessels. A third avascular zone was located in the distal zone of fibro cartilage adjacent to the roof of intercondyler fossa.

In the present study ,histological examination of sections of 5 month fetus ,full term and adult ACL showed the presence of thick collagen bundles and fine fibers in between the thick collagen, fibroblasts intermingled between the collagen.Metachromatic reaction was noted in adult ACL in sections stained by toluidine blue and sections stained by Mallory triple stain.indicating more than one type of collagen.

That results of the present work agreed with Standring et al.(2016) who pointed that forces that developed by skeletal muscles were transferred to bone by tendons , aponeurosis ,and fascia ,where as ligaments prevented excessive separation of adjacent bones. All of those structures comprised dense fibrous connective tissues containing of high proportion of type I collagen.The microstructure and biology of ligaments were broadly similar that of tendons (Rumian et al., 2007). Ligaments consisted of mostly of large crimped fibers of collagen type I, and their cells were predominantly elongated fibroblasts. However there were two major differences between tendons and ligaments: one relating to gross structure, the other to composition .Structurally, ligaments tended to have fibers oriented in a range of directions because they had to resist the separation of bones in more than one direction, whereas collagen fibers in the tendon had aligned with tension in the adjacent muscle. More diverse mechanical roles of ligaments were also reflected in their composition. For example, the ligamentum flavum, which joined adjacent vertebrae in the spine, had a very high elastic content which enabled it to be stretched more than 80% when the spine was flexed, and yet remained under tension in all postures .Maintaining tension was important because that ligament lied adjacent to the spinal cord, and could impinge on it became slack and buckled when the spine was moved to extension.

C-Mechano-neuroreceptors present in the prenatal full term :(33-36 weeks) CRL 31-34cm) developing ACL of human knee joint stained by Gordon and Sweet Silver impregnation method:

In the present work histological examination of serial sections of parts of TS of anterior cruciate ligament ACL of full term human:(33-36 weeks) CRL 31-34cm) stained with Gordon and Sweet Silver impregnation showed the presence of many neuronal elements :spindle shaped structure with one axon,numerous encapsulated nerve ending with spiral or zigzag or striate appearance in Meissener like corpuscles,,which were responsible for light touch . Free nerve endings FNE, and nerves arranged in plexus of nerves which involved in pain were noted. Big oval single Golgi like organ with peri-axial space and large components in a CT capsule, which were involved in

musculature was seen. Large Pacinian corpuscles with lamellae of cell layers darkly stained , around a central white core and the capsule of corpuscle was continuous with the endoneurium which were involved in vibration were noted.Strange structure similar to flower and spray like structure were observed. Raffini like end receptors with ramifications and expanded ends, which were involved in stretch sense were observed. The presence of different types of neuro mehano receptors, and free nerve ending seen were occupying large surface area in the ACL tissue of full term fetus, indicated sensory and mechano kinematics role of the anterior cruciate ligament ACL in the prenatal developing human knee joint.

The results of the present work agreed with Arnoczky (1983) and Mommersteage et al. 1(995) mentioned that the anterior cruciate ligament (ACL) in adult was multi fascicular structure whose femoral and tibial attachments, and spatial orientation in the knee were directly related to its function as a constrain of joint motion. The nerve supply to (ACL) originated from the tibial nerve .Although the majority of the fibers appeared to have vasomotor function, some fibers might serve proprioceptive or sensory function.

The results of the present work coincided with Krauspe et al. (1995) described the distribution of neurofilament containing nerve fibers and corpuscular like endings in the human anterior cruciate ligament using immunocytochemical study. They found neurofilament –positive fibers in the bundles. The bundles were mostly located near blood vessels in the sub synovial layer and in interfascicular gaps. Only a few single nerve fibers were found independent of blood vessels in inter fascicular gaps and between collagen bundles. Two types of corpuscular -like endings were found i.e. "spiral like "type I and spray like"type II endings .Similarly to nerve fibers, both types of corpuscular -like endings were found mainly near the tibial and femoral attachment sites. They added that most likely "type I and "type II corpuscular -like endings served a mechanoreceptive function involved in the sensory control of normal movements and stress function.

The results of the present work were similar to Petersen and Tillmann (2002) who reviewed the anterior cruciate ligament ACL in adult human and published that the femoral origin and the tibial insertion of ACL had the structure of condral apophyseal enthesis. Near the anchoring region of the femur and tibia, there should be various mechanoreceptors, which might have an important function for the kinematics of the knee joint.

The results of the present work were similar to Freemen and Wyke's classification after studding the cat joints .They classified the nerve endings into encapsulated nerve endings in the synovium: Ruffini endings were low threshold, slow adapting mechanoreceptors (Type 1); Pacinian corpuscles were low threshold, rapidly adapting mechanoreceptors (Type 2); Google organs, not associated with blood vessels, were high threshold, slowly adapting mechanoreceptors (Type 3); and free nerve endings were pain receptors (Type 4). Besides, Grönblad et al., who pointed that substance P-immunofluorescent nerves that were involved in pain transmission and were found in human knee synovial membrane and menisci. Both tissues contained enkephalin-immunofluorescent nerves, which might be involved in the modulation of pain transmission. The presences of nociceptive receptors in these non cartilaginous joint structures, were made on a histological basis, and were confirmed by immunohistochemical methods.

The results of the present work were similar to Wu et al. (2015) who analyzed the pattern and types of sensory nerve endings in adult ankle collateral ligaments using histological techniques, in order to observe the morphology and distribution of mechanoreceptors in the collateral ligaments of cadaver ankle joint, and to provide the morphological evidence for the role of the ligament in joint sensory function. Twelve lateral collateral ligaments including anterior talofibular ligament (ATFL; $n = 6$), posterior talofibular ligament (PTFL; $n = 6$), and calcaneofibular ligament (CFL; $n = 6$) were harvested from six fresh frozen cadavers. The ligaments were embedded in paraffin, sectioned at 4 μm, and then stained using a modified gold-chloride staining methods. The collateral ligament was divided into three segments: proximal, middle, and distal segments. Fifty-four ATFL slides, 90 PTFL slides, and 108 CFL slides were analyzed. Mechanoreceptors were classified based on Freemen and Wyke's classification. Mechanoreceptor distribution was analyzed statistically. One-way ANOVA (postHoc LSD) was used for statistical analysis.They found all the four typical types of nerve endings (the Ruffini corpuscles, Pacinian corpuscles, Golgi tendon organs, and free nerve endings) were identified in those ligaments. Pacinian corpuscles were the predominant in all four complexes. More mechanoreceptors were found in synovial membrane near both ends of the ligaments attached to the bone. No statistical differences were found in the amount of mechanoreceptors among distal, middle, and proximal parts of the ligaments.The four typical types of mechanoreceptors were all identified in the collateral ligaments of the human ankle. Pacinian corpuscles were the predominant in all four complexes. That indicated that the main function of ankle collateral ligaments was to sense joint speeds in motions.

The results of the present work agreed with Standring et al., (2016) who quoted that the different types of sensory endings showed activation at different

developmental times. Mechanoreceptors and proprioceptors were active ahead of nociceptive neurons prenatally. A third wave of mechanosensetivity acquisition by the remaining nociceptors occurred just after birth (Lehner et al. 2003).

The results of the present work agreed with Snell (2010) and Splittgerber (2019) who reported that free nerve endings were widely distribute throughout the body .They were found between the epithelial cells of the skin, the cornea, and the alimentary tract and in connective tissues, including the dermis, fascia, ligaments, joint capsules, tendons, periosteum, perichondrium, havertian system of bone, tympanic membrane and dental pulp. They were also present in the muscle. The afferent nerve fiber formed the free nerve endings were either mylinated or non mylinated. The terminal endings were devoid of myelin sheath, and there were no Schwan cells covering their tips. Most of those detected pain, while others detected crude touch, pressure and tickle sensation and possibly cold and heat.

In the present study histological examination of serial sections of parts of T.S of anterior cruciate ligament ACL of full term human:(33-36 weeks) CRL 31-34cm) stained by Gordon and Sweet Silver impregnation ,showed many types of neuroceceptos occupying large area of the tissue of the ligament especially near its femoral and tibial attachment. . Large Pacinian corpuscle were present single, each corpuscle had lamellate cell layers darkly stained around a white central core were observed. The inner core invested the afferent nerve, which lost its myelin sheath after entering the corpuscle. The core cells were modified Schwann cells. The capsule of Pacinian corpuscle was continuous with the endoneurium ,and resembled a cut surface of an onion .Meissener like corpuscles with zigzag encapsulated nerve ending ran tortuous inside the capsule giving the striated appearance of the corpuscle were` seen .Spindle like structures with one axon were` noted. Encapsulated structures with spiral end receptors. Free nerve endings FNE and bundles of nerve fibers were noted. Structures similar to Golgi –like organ were seen. Raffini endings like structures displayed dendritic ramifications with expanded terminal buttons were present. Strange structure similar to flower was observed. Spray like structures were noted. . The different types of mechano-neuroreceptors receptors and free nerve endings occupied large surface area in the tissue of ACL of full term fetus.

The results of the present work agreed with Banios et al. (2022) mentioned that proprioception was a specialized sensory modality encompassing the movement of the joint and its position in space. There were three main functions of proprioception:

1. Static awareness of joint position;
2. Awareness of joint movement and acceleration;
3. Reflex responding and regulating muscle activity.

Proprioception had an important role in preventing injuries and maintaining function of the knee joint [Freeman and, Wyke . 1967 The sense of proprioception involved MRCs, which were specialized nerve structures able to transmit mechanical deformation through electrical signals to dorsal root ganglion sensory neurons. Mechanoreceptor was a subtype of somatosensory receptor. It conveyed extracellular stimuli through intracellular signal conduction via a mechanically gated ion channel. It conveyed not only kinetic stimuli, but also pressure, stretching, touch, and even sound wave.

يوم تشهد عليهم ألسنتهم وأيديهم وأرجلهم بما كانوا يعملون سورة النور24

وتكلمنا أيديهم و تشهد أرجلهم بما كانوا يكسبون .سورة يس 65

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In the present study, the presence of the Pacinian corpuscles, structures similar to Golgi –like organ appeared as component present in cluster surrounded by a capsule, and Raffini like endings. Besides free nerve endings were seen .These encapsulated mechano neuroreceptor -structures in the tissue of ACL of full term prenatal human fetus, were similar to the results of Freeman and Wikly in the cat synovial joint. However, Freeman and Wikly did not mention Messieners –like corpuscles, which were noted in the present work of the prenatal developing ACL oF Human knee joint. ?????However they might be considered atypical non-classified type of neuromchanoreceptors.

Freeman and Wikly mentioned that Type I, Ruffini endings were involved in stretch ; type II, Pacinian corpuscles were involved in vibration; type III, Golgi tendon organs were responsible in of muscle control system; and type IV, free nerve endings had role in pain perception and modulation. The mechano neuro receptors in the anterior cruciate ligament ACL of full term of the developing prenatal human knee joint indicated that the sensory system of the ACL cruciate ligaments was able to significantly contribute to the functional stability and kinematics of the knee joint.

Ruffini mechanoreceptors were reported to contribute in muscle stretch and tone, Pacinian corpuscles and Golgi tendon organs were stimulated during movement, and free nerve endings were nociceptors. Thus, in the present study, neuroreceptors in the ACL of the human prenatal developing knee joint were able to produce a discriminating afferent inflow to the central nervous system (CNS), and contributed in the knee joint protection, in addition to functional stability of the knee joint by preprogramming of the muscular stiffness around the knee joint and thereby of the knee joint stiffness.

The results of the present work agreed with Zimny et al. (1986) who mapped and analyzed the human

anterior cruciate ligament ACL, using a computerized, morphometric, to obtain the percentage of receptors in. They took Ligaments from six human subjects were at autopsy, cut into cross-sectional segments 1.0-1.5 cm thick, and kept oriented as to the femoral and tibial attachments. They stained segments in bulk by using a modified gold chloride method, then frozen, and sectioned on a sliding microtome at 100 microns. The sections were floated in alcoholic gelatin, mounted on slides, dehydrated, and covered slipped. Light microscope studies of serial sections and photographing the receptors were done. They made Cross-sectional maps of every tenth section outlining the periphery of the ACL and the receptors within that section. They found that in addition to free nerve endings, two morphologically distinct mechanoreceptors were identified: (1) Ruffini end organs and (2) Pacinian corpuscles. Their preliminary morphometric analyses showed that populations of mechanoreceptors were greater at the femoral and tibial ends of the ligament and constituted approximately 2.5% of the ligament. They concluded that the human ACL had a discriminating afferent outflow to the central nervous system.

The results of the present work agreed with Schutte et al. (1987) who identified in the anterior cruciate ligament ACL, in human cadavers. Three morphological types of mechanoreceptors and free nerve endings. Two of slowly adapting Raffini type and the third, rapidly adapting Pacinian corpuscle. The rapidly adapting receptors signaled motion and slowly adapting receptors subsurved speed and acceleration. Free nerve endings, were responsible for pain were also identified. Those neural elements comprised one per cent of the area of anterior cruciate ligament.

The results of the present work was accordance to Johansson et al. (1991) who reviewed the morphologic, physiologic, and clinical evidence for the sensory role of the cruciate ligaments. They found that the cruciate ligaments accommodated morphologically different sensory nerve endings: (Ruffini endings, Pacinian corpuscles, Golgi tendon organ like endings, and free nerve endings) were noted with different capabilities of providing the central nervous system with information about noxious and chemical events, and characteristics of movements and position-related stretches of those ligaments. Their survey of the available data revealed that low threshold joint-ligament receptor (i.e., mechanoreceptor) afferents evoked only weak and rare effects in skeletomotor neurons (alpha-motor neurons), while they frequently and powerfully influenced fusimotor neurons (gamma-motor neurons). The effects on the gamma-muscle-spindle system in the muscles around the knee were so potent that stretches of the cruciate ligaments at moderate loads (not noxious) might induce major changes in responses of the muscle spindle afferents. As the activity in the primary muscle spindle afferents modified the stiffness in the muscles, the cruciate ligament receptors, via the gamma-muscle-spindle system, might participate in the regulation and preprogramming of the muscular stiffness around the knee joint and thereby of the knee joint stiffness. They concluded that, the sensory system of the cruciate ligaments was able to significantly contribute to the functional stability of the knee joint by preprogramming of the muscular stiffness around the knee joint and thereby of the knee joint stiffness.

The results of the present work was accordance to Zimny and Wink (1991) who mentioned that Ruffini mechanoreceptors were believed to contribute mainly to maintenance of muscle tone, Pacinian corpuscles and Golgi tendon organs were stimulated during movement, and free nerve endings were nociceptors. Thus, receptors of the knee joint were able to produce a discriminating afferent inflow to the central nervous system (CNS), thereby contributing to the protection and function of the joint through the musculature. They stated that four types of receptors had been described in the articular tissues of the knee joint in humans and animals. The first three types were encapsulated; the fourth was unencapsulated: type I, Ruffini endings; type II, Pacinian corpuscles; type III, Golgi tendon organs; and type IV, free nerve endings. Ruffini endings, Pacinian corpuscles, and free nerve endings were most prevalent in the fibrous joint capsule; Golgi tendon organs were most common in the collateral and cruciate ligaments and the menisci. In the anterior and posterior cruciate ligaments (ACL, PCL), receptors were concentrated at the tibial and femoral attachments of the ligaments. In the menisci, neural elements penetrate the horns and the outer and middle thirds of the body. However Zimny and Wink (1991) did not mention the Miesseners like corpuscles.

In the present work histological examination by light microscope of serial sections of part of anterior cruciate ligament of full term fetus of the prenatal developing human knee joint stained by silver impregnation ,Gordon and sweet method showed the presence of oval encapsulated mechanoreceptors Meissner 's like corpuscle with Zigzag and striated appearance . That was in accordance to Gartner and Hiatt (1994) who described Meissner's corpuscle in Paraffin sections stained by H&E stain and pointed that Meissner's corpuscle were oval encapsulated mechanoreceptors lying in dermal ridges just deep to the stratum germinativum. They were especially prominent in the genital area,lips,fingers,,and sole of feet .A connective tissue capsule enveloped the corpuscle .The nuclei within the corpuscle belonged to flattened probably modified Schwan cells ,which were arranged horizontally in that structure. The afferent

nerve fiber pierced the base of Meissner's corpuscle, branched, and followed a tortuous course within the corpuscle.

In the present work histological examination by light microscope of serial sections of part of anterior cruciate ligament of full term fetus of the prenatal developing human knee joint stained by silver impregnation ,Gordon and sweet method showed the presence of Pacinian corpuscle having a CT capsule , central core and lamellated cells around the core giving the corpuscle the appearance of a cut onion . The capsule of the corpuscle was continuous, with the endoneurium of the afferent nerve fiber that was similar to Gartner and Hiatt (1994) who described Pacinian corpuscle in Paraffin sections stained by H&E. They stated that Pacinian corpuscle, located in the dermis and hypodermis, were mechanoreceptors .They were composed of a core with an inner and outer regions, and a capsule which surrounded the core. The inner core invested the afferent nerve fiber which lost its myelin sheath soon after entering the corpuscle. The core cells were modified Schwan cells, while the component of the corpuscle was continuous, with the endoneurium of the afferent nerve fiber. Pacinian corpuscle was readily recognized in section since they resembled the cut onion.

In the present work histological examination by light microscope of serial sections of part of TS of anterior cruciate ligament ACL of full term fetus of the prenatal developing human knee joint stained by silver impregnation, Gordon and sweet showed the presence of spray like and spiral like structures. The results of the present work were in accordance of Krauspe et al., 1995) who studied the distribution of neuro filament positive nerve fibers and sensory endings in the adult human anterior cruciate ligament .They described two types of corpuscular -like endings were found i.e. "spiral like "type I and spray like"type II endings .Similarly to nerve fibers, both types of corpuscular -like endings were found mainly near the tibial and femoral attachment sites. They added that most likely "type I and "type II corpuscular-like endings served a mechanoreceptive function involved in the sensory control of normal movements and stress function.

The results of the present study were similar to Turlough Fitzgerald et al. (2012) who mentioned that the capsules of the three nerve endings had to be described comprised an outer coat of modified Schwann cells (telogalia). All three were mechanoreceptor transducing mechanical stimuli. Meissner s corpuscles were most numerous in the finger pads. Where they lied beside the intermediate ridges of the epidermis. In these ovoid receptors, several axons zigzaz among stacks of teloglial lamellae. Meissner s corpuscles were rapidly adapting .Together with the slowly adapting Merkel cell neurite complexes; they provided the tools for delicate detective work on textured surfaces such as cloth or wood, or on embossed surfaces such as Braille text. Elevations as little as 5um in height could be detected

The results of the present study were similar to Xiaochuan Wu, et al., 2015 who reported that lateral ankle sprain (LAS) and chronic ankle instability (CAI) were becoming a hot spot in the sports medicine and orthopedics research. Their study focused on the morphological structure and distribution of the proprioceptive mechanoreceptors in the lateral ligaments of the human ankle. They used Gold-chloride staining after paraffin sectioning. Their purpose of the study was to provide some morphological evidence for the clinical treatment of the LAS and CAI. They found that all the four typical types of nerve endings (the Ruffini corpuscles, Pacinian corpuscles, Golgi tendon organs, and free nerve endings) were identified in those ligaments. Pacinian corpuscles were the predominant in all four complexes. More mechanoreceptors were found in synovial membrane near both ends of the ligaments attached to the bone. They did not find statistical differences in the amount of mechanoreceptors among distal, middle, and proximal parts of the ligaments. They identified four typical types of mechanoreceptors in the collateral ligaments of the human ankle. Pacinian corpuscles were the predominant in all four complexes. That indicated that the main function of ankle collateral ligaments was to sense joint speeds in motions.

Results of the present work were similar to Snell (2010) and Splittgerber (2019) who mentioned that encapsulated receptors showed wide variation in size and shape, and the termination of the nerves covered by a capsule. Meissner s corpuscles were located in the dermal papillae of the skin, and especially of the palm of the hand and the sole of the foot .Many also were present in the skin of the nipple and external genitalia .Each corpuscle was ovoid in shape and consisted of a stack of modified flattened Schwann cells arranged transversely across the long axis of the corpuscle. The corpuscle was enclosed by a capsule of connective tissue that was continuous with the endoneurium of the nerves that entered it. A few myelinated nerve fibers entered deep end of the corpuscle myelinated and unmyelinated decreased in size and ramify along the Schwann cells. There was considerable reduction in the number of Meissner s corpuscles between birth and old age .Pacinian corpuscles were widely distributed throughout the body and were abundant in the dermis. subcutaneous tissue, ligaments ,joint capsules ,pleura , periosteum,nippeles and external genitalia .Each corpuscle was ovoid in shape ,measuring about 2mm long and about 100 10 500 um across, It consisted of capsule and a central core containing the nerve ending, The capsule consisted of numerous concentric lamellae

of flattened cells. A large myelinated nerve fiber entered the corpuscle and lost its myelin sheath and then its Schwann cell covering. The naked axon, surrounded by lamellae formed of flattened cells, passed through the center of the core and terminated in an expanded end . The Pacinian corpuscle was rapidly adapting mechanoreceptor that was particularly sensitive to vibration. It could respond to up to 600 stimuli per second. Snell added that Raffini corpuscles were located in the dermis of hairy skin. Each corpuscle consisted of several large unmyelinated nerve fibers ending within a bundle of collagen fibers and rounded by a cellular capsule. Those slowly adapting mechanoreceptor were stretch receptor, which responded when the skin was stretched.

The results of the present work agreed with Meghan et al. (2021) who mentioned that Meissner corpuscles, also known as Wagner-Meissner corpuscles or tactile corpuscles, were a subset of mechanoreceptors first described by Professor Georg Meissner and Professor Rudolf Wagner in 1852. Located in the dermal papillae of glabrous skin, these specialized encapsulated nerve endings relayed fine touch and low-frequency vibration sensations to the central nervous system (CNS). Meissner corpuscles played an essential role in somatosensory acuity, especially in the digital extremities and palmar skin, meriting clinical significance for peripheral and diabetic neuropathy as well as age-related degeneration of dermatological tactile sensation. Meghan et al. (2021) added that the external force applied to a Meissner corpuscle was transduced by the collagen fibers connected to the lamellae. The resulting physical deformation induced bending of the nerve axon terminals to generate an action potential. Removal of the stimulus caused normalization of the corpuscle's shape, producing a second set of action potentials. Meissner corpuscles were considered low-threshold phasic receptors in that they adapted quickly to a stimulus. With sustained stimulation, the response of Meissner corpuscles decreased rapidly before ceasing. Such receptors were unable to convey information regarding the duration of the stimulus.However, Meghan et al. (2021) mentioned the presence of Meissner corpuscleseceptors in abnormal sites?. Their presence in ACL in the present study of the prenatal developing human knee joint might be obe and more investigations are needed?.

Meghan et al. (2022) mentioned that the development of Meissner corpuscles was dependent on brain-derived neurotrophic receptor (BDNF) signaling via tropomyosin receptor kinase B (TrkB). TrkB was an enzyme-linked transmembrane receptor encoded by the *NTRK2* gene. Animal studies involving knockout of BDNF or TrkB in mice resulted in a lack of Meissner corpuscles, highlighting the importance of that signaling system in corpuscular development (González-Martínez et al., 2004 &2005; Ichikawa et al.2000)

The results of the present work agreed with Banios et al. (2022) who reviewed the current knowledge of anterior and posterior cruciate ligaments mechanoreceptors and their role in the knee, and reported that the knee joint was composed of complex structures of osseous and soft tissue components that worked in conjunction to allow three planes of motion. The ligaments were the static stabilizers of the knee. The cruciate ligaments were the main restraints of tibial translation relative to femur. The posterior cruciate ligament (PCL) prevented the posterior translation of tibia and, acting as a counterpart to the anterior cruciate ACL which prevented the anterior translation of tibia on the femur.Both the anterior and posterior cruciate ligaments had crucial significant role in knee joint stability. They contributed to dynamic stability of the knee joint via proprioception and activation of knee muscles ,besides being the main restraint against anterior or posterior translation of the tibia relative to the femur, [Many studies demonstrated that MRCs were present in both ligaments (Zimny, et al.,1986;Del Valle, et al.,1998

Summary and conclusion:

The developing intra-articular septum (septum genu) in 4month, 5month fetus was noted.The broad septum divided the joint cavity into two joints. That septum decreased in broadness with age progress as pits and foramina appeared at the edge sides of that intra articular septum .At the age of 5,6 month fetus there were small tiny colliculi and bands .Those thickened parts of the septum were prominent at the age of 8 month showing defined thickened colliculi and bands in its middle . These colliculi and bands in the prenatal developing intra articular septum might be the precursor of the future different functional bands of the anterior ACL and posterior PCL cruciate ligaments. That septum was absorbed with age progress and at full term fetus was differentiated into 3 bands: the menisco-femoral MFL ligament and the anterior ACL and posterior PCL cruciate ligaments. The histological examination of ACL primordium in the age of 5 months fetus showed its consistency of short wavy collagen bundles loosely packed and in between them fine fibers could be seen .Big fibroblast were noted. At full term the ACL consisted of net work of thin brabched and united collagen bundles that were longer thinner wavy packed more branched than the precious age .Adult ACL showed that the collagen bundles were more packed longer thinner wavy more branched and reunited forming network than the previous prenatal ages .Very thin fine fibers between the collagen bundels were observed. Metachromatic reaction in the extra

cellular substance with toluidine blue stain was noted. At the adult ACL attachment the tissuediffered from the whole ligament and became fibrocartilage with excess collagenon and single or twin cartilage cells in capsule arranged in rows.That was transitional form of tissue to strengthen the ACL tissue to accommodate knee joint function .That was not noted in the previous prenatal ages studied in the present work. That was mentioned in the Holy Quran Surt el ensane 28 and suret al haj 5 shodakom, suret kafer (forgiver) 67, and suret Al ah akaf.15

In the present work Histological examination of parts of T.S of serial sections of parts of anterior cruciate ligament ACL of full term human:(33-36 weeks) CRL 31-34cm) stained with Gordon and Sweet Silver impregnation Showed the presence of fusiform structure with one axon, numerous spiral and zigzag encapsulated nerve ending in Meissener like corpuscle. Free nerve endings FNE .and the plexus of nerves, Golgi like organ were seen. Pacinian corpuscle with layers of cells arranged in lamellae darkly stained and the capsule of Pacinian corpuscle was continuous with the endoneurium.Strange structure similar to flower and spray like structure was observed. The different types of mechano receptors and free nerve endings occupied large surface area in the tissue of ACL of full term fetus indicated sensory and mechano kinematics role of the ACL cruciate ligament in the developing human knee joint.

In the present work the histological examination of ACL primordium in the age of 5months showed its consistency of short collagen bundles loosely packed with many big fibroblasts. At full term the collagen bundles were longer thinner wavy packed more branched and reunited forming network than the precious age .Adult ACL showed that the collagen bundles were more packed longer thinner wavy more branched and reunited forming network than the precious ages. At the adult ACL attachment the tissue was fibrocartilage with excess collagenous to strengthen the ACL tissue to accommodated knee joint function .That was not noted in the previous prenatal ages studied in the present work.That was mentioned in the Holy Quran Surt el ensane 28 and suret al haj 5 shodakom, suret kafer(forgiver)67,and suret Al ahakaf.15

The transformation of ACL at the extreme ends of ACL from tissue containing thick collagen bundles and fine fibers in between in addition to fibroblasts and fibrocytes to another different tissue :fibro cartilage with excess collagen very thick and cartilage cells lied in rows between the collagenous bundles ,usually single but sometimes two cells might be found inside a capsule at sites of attachment to long bones in adult. That was to provide more strength and fortification to the ACL and then the knee joint.Suert Lukman 11/Suret al thareate(21)That agreed also with Suret AL MOEMENOON KALKAN AKR suret Al moemenoon(The believers- The faithful people) 14: another creation other than the former kalkan akr . خلقا آخر The emerging of anterior ACL and posterior PCL cruciate ligaments and menisco femoral ligaments at stages was mentioned in suret NOOH13&14.

In the present study, morphologic and histological changes occurred in the developing intra articular septum of the prenatal human knee joint, with age progress. An intra articular septum was detected at the age of 3month dividing the joint into medial and lateral joints .At age 4month fetus, that septum was not uniform in thickening. At age 5month fetus,the intra articular septum had multiple tiny round thickenings and foramen were seen the medial and large sides of the septum, as well as small pit at the edges of the septum. Small upper foramina in the septum at the intercondylar fossa were detected. At the age of 6month fetus,the intra articular septum had more thickened areas and the medial foramen was larger than the previous age , besides small lateral larger foramen at the lateral side. The upper foramina in the septum at the intercondylar fossa increased in width. The septum decreased in broadness with age progress. At the age of 7month fetus, additional foramina in the upper part that septum were noted .The appearance of areas of detachment of the septum from the intercondylar fossa was observed. At the age of 8month fetus, differentiation of two small bands and many round thickened areas from the middle of the intra-articular septum were noted. The intra-articular was narrower than the previous ages . At the age of full term 33-36 weeks) CRL 31-34cm) , the intra articular septum was between the femoral condyles and differentiated into three bands, posteriorPCL and anterior cruciateACL ligaments and menisco femoral ligament MFL,AND THE INTRA-ARTICULAR SEPU WAS ABSORBED..The adult had complete differentiated strong thick cruciate and meniscofemoral ligaments.Histological changes in the prenatal developing (cruciate PREMORDIUM) anterior cruciate ligament ACL were noted as follows: at the age of 5month, the tissue of cruciate PREMORDIUM was formed of short straight loosely packed collagen bundles .They increased with age progress at full term as the collagen bundles were longer, wavy, closely packed ,branched and re united more than the previous age . The collagen bundles formed a net work. Some fine fibrils of collagen fibers were between the thick bundles. The full term ACL showed a metachromatic reaction in the extracellular substances around oval big cells. At adult ACL Thick and thin collagen bundles indicating different types of collagen forming network were noted At site of attachment the ant cruciate

ligament differed from the allover the ligament tissue and became fibrocartilage.

The previous morphologic and histological changes occurred in the developing intra articular septum of the prenatal developing human knee joint, with age progress, had occurred in consecutive steps and stages stages although few overlap ,that agreed with the Quraan that Allah created the human in creation after creation- Suret Al zomar 6,and the creation was in stages suret Nooh 14.

The absence of anterior or posterior MFL was accordance to suret Al Omran verse-6: Allah pictured photographed the creation of human as He wishes.

The change from weak ACL formed of collagen and fibroblasts, and changed to fibrocartilage tissue at the attachment of the ACL with tibia or femur to provide more strength was according to SURET

- Threate21
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- That what what We build up ,We will turn down,-Yasseen 68
- سنريهم آياتنا في الأفاق و في أنفسهم حتي يتبين لهم أنه الحق –سورة فصلت 53
- We will show them our miracles in the realem heaven and in themselves till the truth is clear obvious to them sure–Fusilate 53
- صوركم فأحسن صوركم –غافر 64
- الجاثية 4وفي خلقكم وما يبث من دابة آيات
- There are miracles in your creation and in what spread from dab(every insects , animals , in earth and sea) and birds
- وقوله تعالي : {من نطفة خلقه فقدره} [عبس/19]،
- وقوله تعالى: {و في خلقكم وما يبث من دابة آيات لقوم يوقنون} [الجاثية/4]

- قوله تعالى ه{ وفي أنفسكم أفلا تبصرون } .. 21..الناريات
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- ، قال تعالى: {ثم نخرجكم طفلا،ثم لتبلغوا أشدكم } الحج 5 ،{ثم يخرجكم طفل ثم لتبلغوا أشدكم ا} غافر/67
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Aknowlegment

Thanks to Allah we established for the first time the stages of emerging of the cruciate ligaments from the developing prenatal intra articular septum of the knee joint *septum genu)

NB: Worth Mention: To Whom It May Concern:

All the papers published by nasra ayoub, about musk and basil(ocimum basilcum) were stolen from prof manal g abd elwahab,the papers were stolen, by Nasra Ayoub,Soad Hanem, Fergani,Mansi ,Alaa El Deen ,as the work about aromatherapy by musk and basil were published in the magazines of Ejaz, Muslim world League THE year 1433 HIJI number 40 pp 11&41pp34 and on the cover of the magazine In addition,Prof Manal . produced and discussed five written projects in English about MUSK AND BASIL aromatherapy in front of the scientific committee of the chair of applied Prophetic Medicine at King Fahd center, KING Abdul-Aziz university-Jedda -KSA, in the presence of ,Prof MOSSA Shaker.Soad jaoni, ,Prof Sawsan Rohayem THE Prof of the chair ,and 40 international scientists and the signature of the attendance ,besides the secretory of the chair Rasha.Nasra Ayoub stole one single research about musk -THE FIRST SERIAL PAPERS OF MUSK and Badi. .Nasra Ayoub stole 8 shared papers ,and attributed the work to her self first name.,Soad Stole 7 papers. The work of musk and basil was after reaches for 10 years by Prof Manal. Nasra atrebuted only one paper about musk to Manal and another 4 papers only.Nasra and Soad attributed two papers to themselves and 4 other thieves, whom had nothing to do with the project ,although the project and the the applied experiment was one belonged to Manal .Nasra cheated and signed the name of Manal on the contract of King Abd Aziz university with out the knowledge of Prof Manal. Soad Jaoni,Abd Gawad SAWI,and shiek Abullah MUSLEH took the thieves NASRA and Soad SHAKER TO PRESENT THE STOLEN PAPERS ,TO Dubie conference, the year 2019. Soad

Jaon, the survisor of the chair of the prophetic medicine ,Abd GAWAD SAWI, shiek MUSLEH had kwon that the papers were stolen ,in spite of that, they took the thieves and supported them to present the stolen papers.Only the good straight person was Prof dr KORAYEM who was the director of the research unit in the university and chief editor of Ejaz magazine had terminated the presence of Nasra and Soad Shaker from the research unit in the university after their non-honest work and steeling of the work of Prof dr, Manal about musk and basil

Thanks to Prof Dr Emad Awad : Prof of density – KSA and Abdel Wahab Sawsan G : Consultant of obstetrics and gynecology – Ohod Hospital - El Madina el monawara. KSA

Role of Manal G. Abdelwahab- :Knee Dissection, collecting specimens ,staining slides, photographing , writing and revising the paper.

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Al Shawkani: The fortified from the talks of the prophet: First Edition 2007-1428higri -4 street of al gameel air-Algeria – phone (021)266016-267152-Fax (021) 267165
Moktar Al Sehah

Dedication:

The present work is dedicated to Allah Who gave me knowledge. To our parents. To EGYPT. To Al azhar University. To whom are concerning with knowledge.