# Morphological and Histological Prenatal Studies on Some Structures of the Developing Human Knee Joint Part 2-Prenatal Development of Human medial meniscus of the Knee Joint with emphasis on collagen orientation

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**Abstract:** The medial menisci in human knee joint knee have important mechanical function and are liable to injury more than the lateral menisci. histological, histomorphometric and statististical studies were done of the medial menisci of the Prenatal and were compared with adult. Thirty three human fetuses of different sexes and ages (3, 4, 5, 6, 7 & 8 months) from (12-13 wks-CRL 8- 9 cm) to eight and full-term: (33-36 weeks) CRL 31-34cm) and five newborn infant (37-38 weeks) CRL 35-36cm) were used in this study, besides five adult male and female knee joints: (21 -24 weeks) CRL 20-23 cm. The medial menisci of 3- months aged fetuses (12-13wks-CRL 8- 9cm)-showed primitive structure as it was formed of loose mesenchymal tissue which had few collagen fibers and was rich in blood capillaries. The tissue became more cellular by the age of 4 months of intrauterine life (13-16 wks-CRL 9-14cm**).** The medial menisci of 5 months (17 -20weeks) CRL 15-19cm., and 6 months aged fetuses (21 -24 weeks) CRL 20-23cm started to be not uniformed in structure, as two distinct areas could be detected: central (inner) zone adjacent to the intercondylar area of the upper surface of the tibia and peripheral (outer) zone attached to the capsule of the joint and the medial collateral ligaments. The (inner zone had cartilage –like appearance, while the outer zone appeared fibro cartilaginous. As age progressed from 7 months intrauterine life (25-28 weeks) CRL 24-27cm) to full term in both meniscal zones, the cellular component decreased while collagen fibers increased gradually especially in the outer zone. The collagen bundles appeared thick. wavy and branching. In full-term and adults collagen bundles appeared branching and intersecting in a parallel manner while those of the inner zone were circularly arranged. Collagen bundle thickness was measured using the image analyser Lieca Q500MC program. There was gradual increase in the collagen bundle thickness as the age progressed. The increase was significant in adult group as compared to full term fetuses: (33-36 weeks) CRL 31-34cm) (P>0.05). different collagen orientation in the inner and outer zones of the medial menisci might explain why peripheral tears heal with preserving the meniscal function while radial tears might heal but donot preserve the meniscal function.

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**Key words**: human Knee joint, development, medial meniscus, embryo histogenesis,

## 1. Introduction

The medial menisci are semilunar structures that have important mechanical function. T hey are important for shock absorption and maintain knee joint stability and congruity (Adams and Muir 1980).

Most of the studies referred to the development synovial joints in general. Streeter (1949) mentioned that during development, the skeletal mesenchyme appeared as a general condensed mass not demarcated from the surrounding myogenic tissue. Later, centers of condrification and later ossification appeared in the mesenchymal core and rapidly extended to delineate the individual skeletal elements in the form of laminae. Some regions did not progress into cartilage or bone but remain as plates of the interzonal mesenchyme. These were the sites of future joints.

In th synovial joints, the interzonal mesenchyme became trilaminar: two dense strata attached to the cartilaginous end s and an intermediate stratum that merge with the general mesenchyme of the limb which was vascularized. From that a cuff condensed as the fibrous capsule of the joint (Gardner and O Rahilly, 1968), They added that the dense strata of the interzonal mesenchyme became cartilaginous. cavitation of the intermediate zone establishes the cavity. (Garder and Gray 1953).

The synovial mesenchyme formed the synovial membrane and probably gave rise to all other intra-

articular structures such as tendons, ligaments, discs and menisci

Adult meniscus are fibrocartilagenous but form marked histological microheterogenicity with hyalinised areas intermixed with fibrous areas (Adams and Ho 1987).

The medial meniscal injuries are more frequent than those of the lateral ones (William, et al., 1995). The age related structural changes in the structure of the medial meniscus are important for the knee stability and congruity. So, the aim of the present work is to throw more lights on the prenatal development of the structure of the medial meniscus which may explain the function in the post natal life and provide a guide about suitable methods for treatment and reconstruction of injured medial meniscus.

## 2. Material & Methods:

33 Human (male and female) fresh fetuses aged 3, 4, 5, 6, 7, 9 months (full term) and new born infant) -{3-9 months old fetuses (12-13wks-CRL 8- 9cm) to full-term: (33-36 weeks) CRL 31-34cm) 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 from Gynecology and obstetric department Al -Zharaa hospital-Cairo -Egypt (according to medical ethics ). They were used in studying the normal morphogenesis and histogenesis of the developing knee joint.

- 4 adult knee joints from new cadavers (male and female) were also used in this work for reason of comparison. The cadavers were obtained from the Dissection room at the – Anatomy Department -Al Azhar University -Cairo –Egypt. Dissection of both sides of the developing and adult knees was done Dissection was held according to Romanes ( 2000) in three stages: a) To expose the outer most 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 infra-patellar synovial fold and fat, then the infra-patellar 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 crutiate ligaments. Finally the femur was removed. Then specimens were fixed in formalin.

To illustrate the morphology of the developing knee joints, photos were photographed by Canon camera zoom. (The anterior aspect and the quadriceps tendon in each joint was sectioned and the patellar flap retracted distally.

**Histological study:**

In each joint, the medial meniscus as a whole was obtained by careful and complete separation from the upper surface of the tibia (Figs A, B, & C) specimens from the menisci of the knees, of 3,4,5,6,7,8 months fetuses and full term as well as adult meniscus were collected freshly and fixed in 10% formol saline solution for 10 days, then dehydrated, cleared in benzene, embedded in paraffin blocks, were done with careful orientation of central (inner) and peripheral (outer) borders. The inner border was adjacent to the intercondylar area of the upper surface of the tibia and the outer border was at the periphery and was attached to the capsule of the joint and the medial collateral ligaments, A piece of liver tissue was embedded beside the inner zone of the meniscus to easily recognize and define the inner and outer zones. Paraffin serial transverse sections of 7 microns thickness were cut and stained with Haematoxylin and Eosin stain for detection of general histological structures, Mallory's triple stain and Toluidine blue stain to investigate and evaluate collagenous tissue. (Drury & Walington, 1980) and ( Bancroft and Stevens1996 ).

The CRL of each fetus was obtained and then converted into weeks of prenatal ages according to tables of Streeter (1920), Langman (1975) and Sadler ( 2012 Table (1))

Table (1) prenatal ages according Sadler ( 2012)

**Table (1): Growth in Length and Weight During the fetal Period**

| Proposed Age (months) | Age (wks) | Crl (cm) | Weight (g) |
|---|---|---|---|
| 2-3 | 9-12 | 5-8 | 10-45 |
| 3-4 | 13-16 | 9-14 | 60-200 |
| 4-5 | 17-20 | 15-19 | 250-450 |
| 5-6 | 21-24 | 20-23 | 500-820 |
| 6-7 | 25-28 | 24-27 | 900-1,300 |
| 7-8 | 29-32 | 28-30 | 1,400-2,100 |
| 8-9 | 33-36 | 31-34 | 2,200-2,900 |
| 9-10 | 37-38 | 35-36 | 3000-3.400 |

**Histometric and statistical study:**

The collagen bundle thickness of the medial menisci and their analage was measured in all age groups. The measurements was done in five different fields from five different sections. That was done in five different fetuses from each age group as well as the adult group. The measurements were done by using the image analysis Lieca Q500MCprogram. Student t test was used to compare the mean thickness and the P value was determined. ($P<0.05$) =non significant. ($P>0.05$) = significant.

**3. Results**

Photograph of the internal structure of the knee joint of a full term fetus: (33-36 weeks) CRL 31-34cm) showing the medial (m) and lateral menisci. The medial meniscus has an inner border (i) adjacent to the intercondylar sarea of the upper surface of the tibia and an outer border (o) at the periphery and attached to the capsule of the joint and its medial collatersal ligaments.

**Histological Results**

Three months old aged human fetuses: 12-13wks-CRL 8- 9cm:

Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed that the meniscus was primitive in structure as it was uniformly formed of loose mesenchymal tissue rich in blood capillaries. The meniscal tissue was formed of undifferentiated branching mesenchymal cells that were small, few and widely separated with elongated or rounded nuclei (Fig1). In Mallory stained sections, few fine widely separated collagen fibers were seen dispersed in between the cells (Fig 2)

Four months old aged human fetuses: (13-16wks-CRL 9-14cm)

Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed notable increase in the cellular density of the mesenchymal tissue. Most of the cells appeared as irregularly deposited branching undifferentiated cells. Their branches anastomosed. Their nuclei had different shaped and sizes (Fig3). In Mallory stained sections, There was irregular aggregation of collagen.

- Five months old aged human fetuses: (17 - 20weeks) CRL 15-19cm:

Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed that its tissue started to be not uniform in structure as two distinct zones could be detected: central (inner) and peripheral (outer) zones: Both areas differed in their cellular density and distribution.

The central (inner) zones was towards the inner border of the meniscus. It was cartilage-like in structure and was chiefly formed of chondroblasts with flattened nuclei and chondrocytes with rounded nucluei and surrounded by lacunae embedded in pale matrix.

In Mallory stained sections, the matrix appeared homogenous pale bluish. The chondrocytes inside lacunawe often showed twin appearance (Figs 5 & 6)

The peripheral zones was towards the outer border of the meniscus. It was chiefly formed of fibroblasts and fibrocytes with few chondroblasts in its inner part. In Mallory stained sections, this area contained the chollagen bundles in between the different cells. (Figs 5 & 6). Branched Six months old aged human fetuses: (21 -24weeks) CRL 20-23cm.

Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed that there was clear differentiation of the meniscal tissue into 2 zones (central and peripheral).

The central (inner) zone had cartilagenous appearance. It is formed of numerous chondrocytes surrounded by lacunae that often showed twin appearance. They were embedded in pale Matrix. However, on staining with toluidine blue, the cartilage matrix did not show apparent metachromasia (Figs.7,8 & 9)

The peripheral outer zone had fibrocartilagenous appearance and showed thicker collagen bundles branching and intersecting. The main type of cells seen was chondrocytes embedded in lacunae between the collagen bundles. Some of the chondrocytes showed twin appearance Few fibroblasts and chondrocytes were occasionally seen. (Figs.7,8 & 10)
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Seven months old aged human fetuses: (25-28weeks) CRL 24-27cm.

Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed an increase in collagen fibere in the meniscal tissue.

The central (inner) zone started to show deposition of thin, parallel collagen bundles in between the cells which were mainly chondrocytes inside lacuna. twin appearance was rarely seen. (Fig 11)

The peripheral zones also showed increased deposition of thick, collagen bundles branching and intersecting in different directions. Chondrocytes inside lacunae together with few fibroblasts and fibrocytes were seen between the collagen bundles.i.e it had a fibrocartilagenous appearance. (Fig 11)

Eight months old aged human fetuses::: (29-32 weeks) CRL 28-30cm)

Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed that it had almost it had a fibrocartilagenous appearance. There was an increase in the collagen fiber content of both central and peripheral zone that showed more collagen deposition. Collagen bundles were seen branching and intersecting in different

directions. Chondrocytes inside lacunae together with few fibroblasts and fibrocytes were seen between the collagen bundles. (Figs 12 & 13)

Full-term human: (33-36 weeks) CRL 31-34cm): Examination of serial transverse sections of the medial meniscus of the knee joint of this age showed both zones had fibrocartilagenous appearance and showed apparent hypocellularity accompanied by an increase in collagen element. The collagen bundles appeared thick, wavy and branching. There were nearly circular in the inner zone but appeared branching and intersecting in an almost parallel direction in the outer zone. Between the collagen bundles, there were chondrocytes inside lacunae and few compressed fibroblasts and fibrocytes. (Figs 14 & 15)

**Adult Knee Joint**

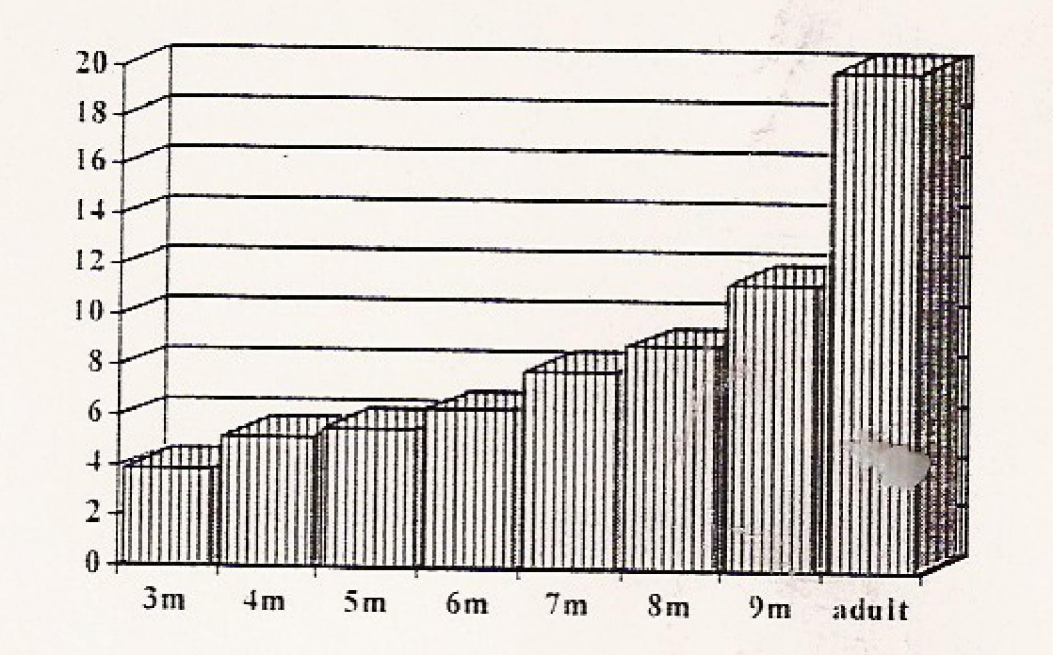
Examination of serial transverse sections of the medial meniscus of the knee joint of adults showed that both zones had fibrocartilagenous appearance and showed marked hypocellularity accompanied by marked increase in the collagen bundle thickness. The collagen bundles appeared thick, wavey and branching. There were nearly circular in the inner zone but appeared branching. They were arranged in nearly circular manner in the inner zone but appeared branching and intersecting in the outer zone in a parallel direction. Between the collagen bundles, there were few chondrocytes inside lacunae and fewer compressed fibroblasts and fibrocytes. (Figs. 16 & 17)

**Histometric and statistical Results:**

Histometric studies using the image analyser Lieca Q500MCprogram showed that there was an increase in the Collagen bundle thickness in the medial meniscus, This increase was progressive with age. There was a significant increase in the collagen bundke thickness between full term and adults (P >0.05).

**Table (2).: Measurements of collagen thickness in the medial menisci in the different age groups:**

| Age | Mean | SD | Max | Min |
|---|---|---|---|---|
| 3months | 4.19 | 1.89 | 9,96 | 1.91 |
| 4 | 5.2 | 3,30 | 10.20 | 2.36 |
| 5 | 5.4 | 2.33 | 12.32 | 3.11 |
| 6 | 5.9 | 1.42 | 13.22 | 3.83 |
| 7 | 7.9 | 2.90 | 14.22 | 4.91 |
| 8 | 8.62 | 2.98 | 14. 55 | 4.92 |
| 9 | 10.93 | 2.69 | 19,28 | 5.57 |
| Adult | 18.24 | 6.88 | 37.99 | 9.27 |




Histogram1: thickness in the medial meniscus

Fig. A- a: A photograph of the leg of a full term fetus (33-36 weeks) CRL 31-34cm anterior veiw showing the the upper surface of tibia bearing medial (m) and lateral. The pattella and ligamenetal patellea is seen.

Fig.A -b:A photograph of part of the leg of a full term fetus (33-36 weeks) CRL 31-34cm higher magnification of of the previous photo showing the anterior upper view of the head of tibia bearing the menisci and the intercondylar area.The patella and fat around it are seen after the ligamental patellea in cut and reflected.

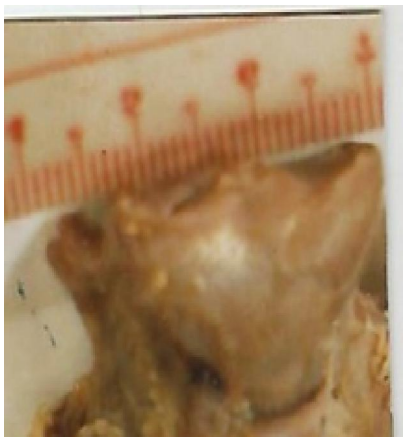
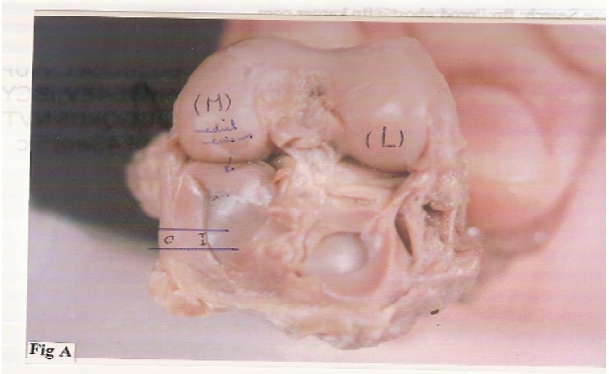
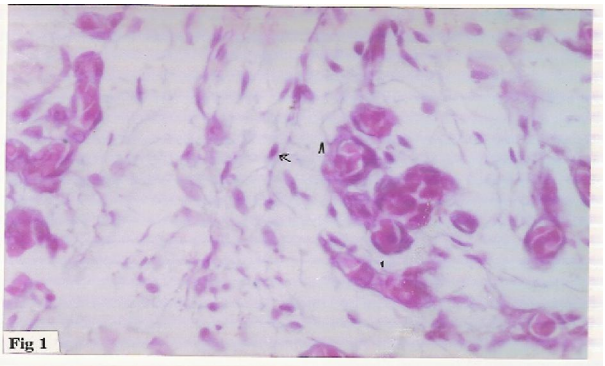


Fig.A -c:A photograph of the internal structure of the knee joint of a full term fetus (33-36 weeks) CRL 31-34cm showing the medial (m)and lateral menisci.The medial meniscus has an inner border (i)adjacent to the intercondylar sarea of the upper surface of the tibia and an outer border (o)at the periphery and attached to the capsule of the joint and its medial collatersal ligaments.



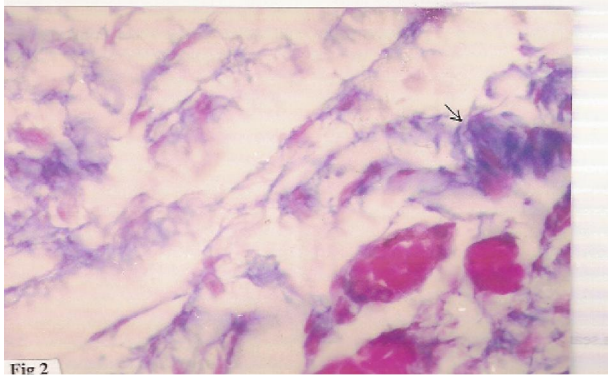
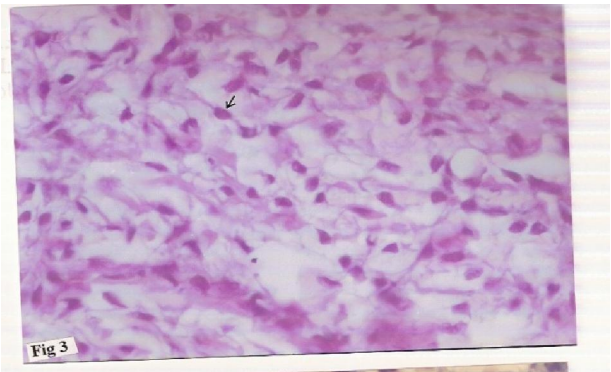
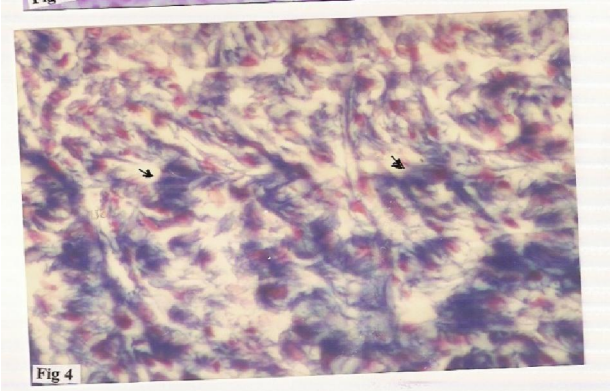




Fig. (1): A photomicrograph of transverse section in part of medial meniscus of 3months aged fetus showing few undifferentiated mesenchymal cells (I) and numerous capillaries (V). H & E x640.

Fig. (2- ): A photomicrograph of transverse section in part of medial meniscus of 3months (12-13wks-CRL 8- 9cm)-aged fetus showing very few collagen fibers (I). Mallory triple stain x640.



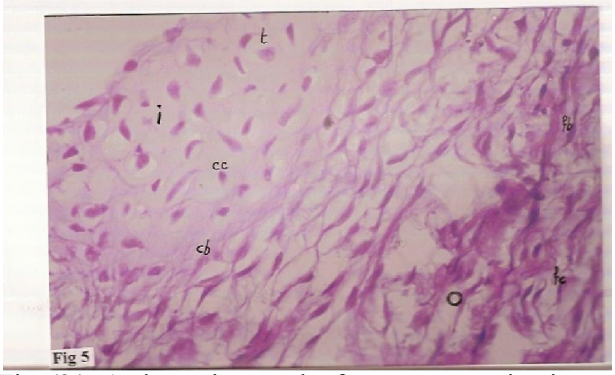
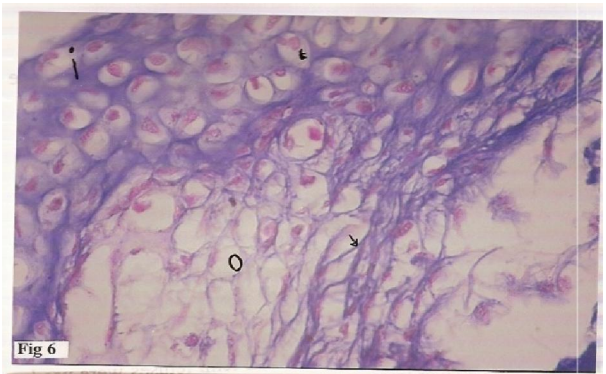
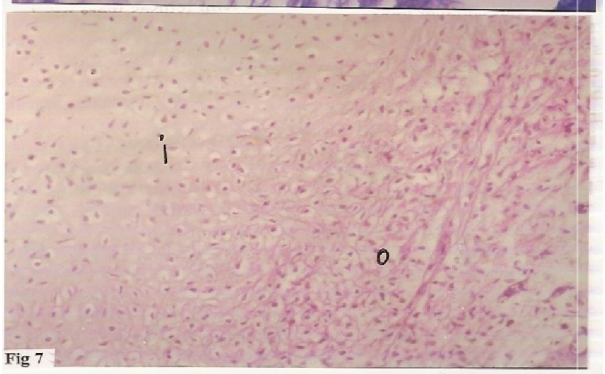




Fig. (3 ): A photomicrograph of transverse section in part of medial meniscus of 4-months (13-16wks-CRL 9-14cm) aged fetus showing numerous undifferentiated branching mesenchymal cells (I). H & E x640.

Fig. (4 ): A photomicrograph of transverse section in part of medial meniscus of 4-months (13-16wks-CRL 9-14cm) aged fetus showing irregular aggregations of collagen fibers in between the cells (I) Mallory triple stain x640

Fig. (5 ): A photomicrograph of transverse section in part of medial meniscus of 5-months (17 -20weeks) CRL 15-19cm aged fetus showing that the meniscal tissue is differentiated into two zones: central inner (I) and peripheral outer (o) zones. Notice, the presence of chondroblasts (cb) and chondrocytes (cc) inside lacunae that sometimes showed twin appearance (t) in the central zone. While the outer zone contained fibroblasts (fb) and fibrocytes (fc). H & E x640.



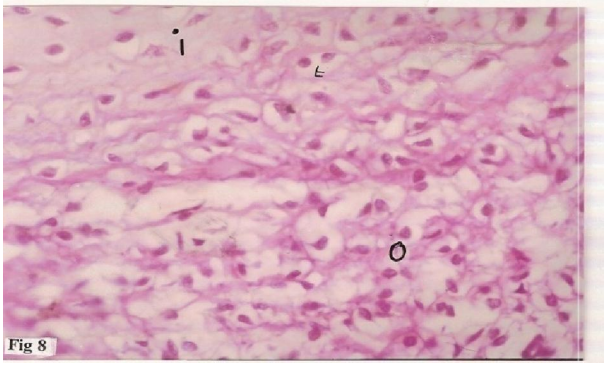




Fig. (6 ): A photomicrograph of transverse section in part of medial meniscus of 5-months (17 -20weeks) CRL 15-19cm aged fetus showing differentiation of the meniscal tissue into two zones. The central zone (i) has cartlage-like appearance in which there are lacunae containing chondrocytes that sometimes show twin appearance (i). The peripheral zone (o) contains thin branched collagen bundles. (I).

) Mallory triple stain x640

Fig. (7): A photomicrograph of transverse section in part of medial meniscus of 6-months: (21 -24weeks) CRL 20-23cm aged fetus showing differentiation of the meniscal tissue into two zones. Notice, the cartilaginous appearance of the central zone (j) and the collagen bundles in the peripheral zone (o). H & E x640

Fig. (8): A higher magnification of the previous section showing that both the central (i) and peripheral zones (o) contained chondrocytes inside lacunae that sometimes showed twin appearance (i). H & E x640.

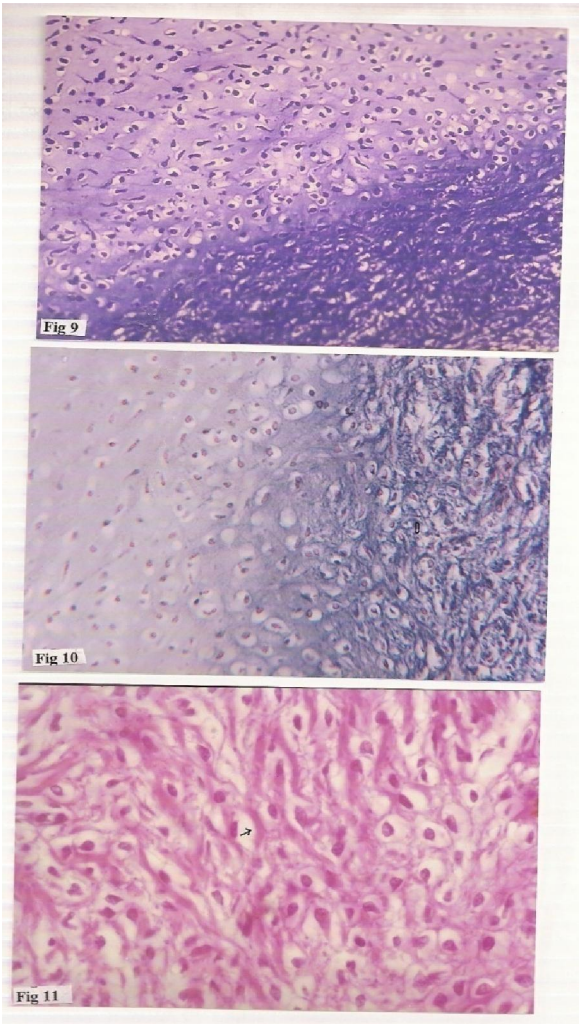



Fig. (9 ): A photomicrograph of transverse section in part of medial meniscus of 6-months: (21 -24weeks) CRL 20-23cm aged fetus showing the matrix of the central cartilaginous zopne (i) did not show apparent metachromasia. Toluidine bluex250

Fig. (10 ): A photomicrograph of transverse section in part of medial meniscus of 6-months: (21 -24weeks) CRL 20-23cm aged fetus showing the prominent collagen bundles in the peripheral outer zone (o). Mallory triple stain x250

Fig. (11 ): A photomicrograph of transverse section in part of medial meniscus of 7 months fetus: (25-28weeks) CRL 24-27cm aged fetus showing the collagen bundles are more prominent in the peripheral outer zone (o). H & E x640.

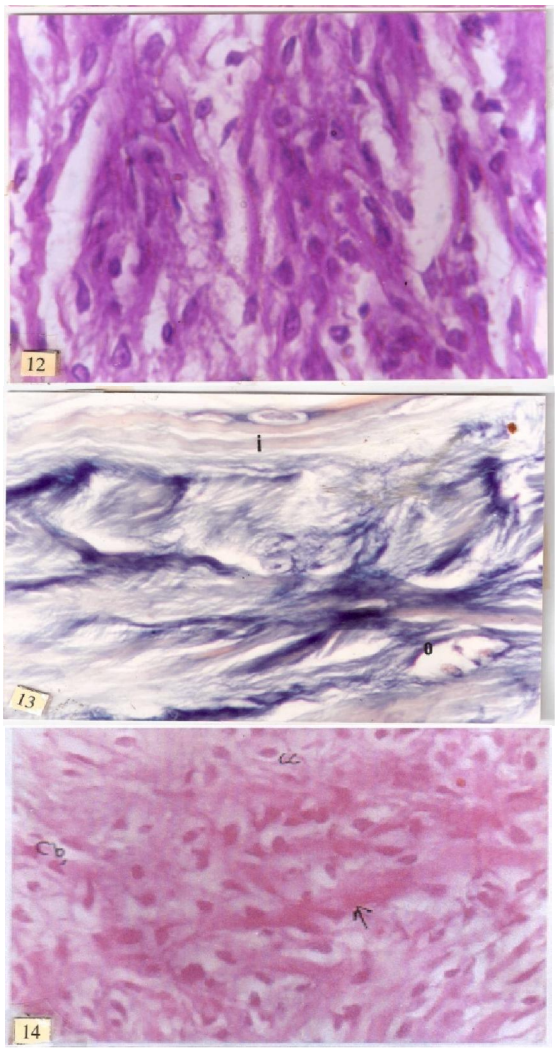



Fig. (12 ): A photomicrograph of transverse section in part of medial meniscus of 8-months aged fetus: (29-32 weeks) CRL 28-30cm) showing more collagen bundles fibers in the peripheral outer zone (o) than in the central zone (i). H & E x640

Fig. (13 ): A photomicrograph of transverse section in part of medial meniscus of 8-months: (33-36 weeks) CRL 31-34cm) and newborn infant (37-38 weeks) CRL 35-36cm) aged fetus showing more collagen bundles fibers in the peripheral outer zone (o) than in the central zone (i). Notice, the collagen bundles are seen running in different directions. Mallory triple stain x250

Fig. (14 ): A photomicrograph of transverse section in part of medial meniscus of a human full term aged fetus: (33-36 weeks) CRL 31-34cm) showing chondrocytes inside lacunae (cc) and fibroblasts and fibrocytes (f) compressed between the prominent collagen bundles. (c). H & E x640

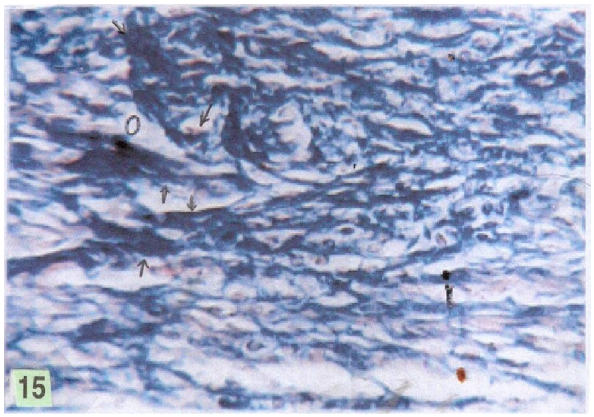



Fig. (15 ): A photomicrograph of transverse section in part of medial meniscus of a human full term aged fetus 33-36 weeks) CRL 31-34cm) showing thick collagen bundles which are arranged nearly in circular in the central zone and are branching and intersecting in parallel direction in the peripheral zone (o). Mallory triple stain x 640

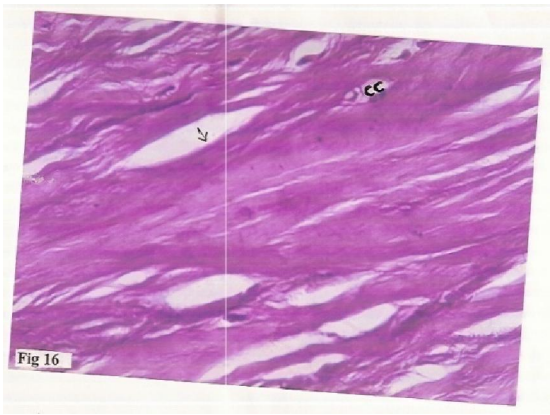



Fig. (16 ): A photomicrograph of transverse section in part of medial meniscus of a human full term aged fetus 33-36 weeks) CRL 31-34cm showing very thick collagen bundles (I) whith few chondrocytes (cc) inside lacunae in between the collagen bundles. H & E x640

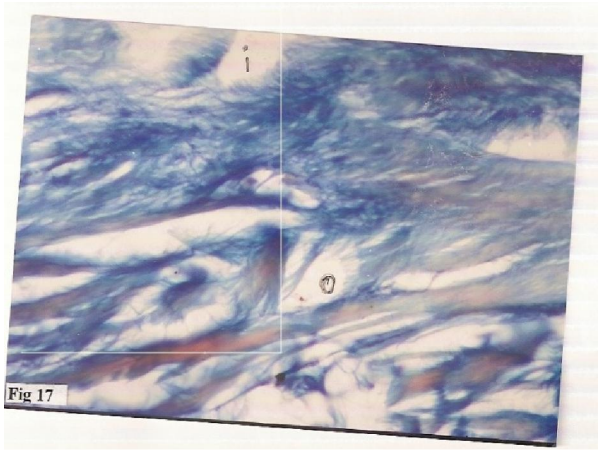



Fig. (17 ): A photomicrograph of transverse section in part of medial meniscus of adult human showing thick collagen bundles running circularly in the inner zone (i) and branching and intersecting in outer zone (o). Mallory triple stain x 640

**4. Discussion:**

In the present work, the medial meniscus was chosen to be studied because its injuries were more frequent than those of the lateral meniscus. The great liability to injuries of the medial meniscus might be due to its firm attachment to the capsule and medial collateral ligament of the knee joint, while the lateral meniscus was less fixed because its outer border was separated from the capsule and from the lateral collateral ligament of the knee by the tendon of the popleteus muscle. In addition the lateral meniscus was found to be rather mobile and could easily adopt itself to sudden twisting movement of the knee (Williams et al.,1995)

In the present study the medial meniscus of 3-months aged fetuses (12-13wks-CRL 8- 9cm)-was primitive in structuren as it was founed to be formed of loose mesenchymal tissue with few dispersed small undifferentiated cells. widely separated by fine collagen fibers was rich in blood capillaries. That agreed with Doskocil (1984) who studied the early prenatal development of the human knee joint and noted the knee joint of three month aged fetuses contained a broad septum (the mediastinum genus ) in which there were many vessels. They added that those vessels fed the cruciate ligaments analage and the cartilaginous and adjacent bone analages.

In the present study in 4- months aged fetuses (13-16wks-CRL 9-14cm), the mesenchymal tissue became hypercellular and as age progressed the cells differentiated into fibroblasts, fibrocytes, chondroblasts, chondrocytes (cells of the future cartilaginous and fibro cartilaginous tissue of the medial meniscus. In 5months 17 -20weeks) CRL 15-19cm and 6- 21 -24weeks) CRL 20-23cm months aged fetuses, the medial meniscus started to be not uniform with an inner cartilaginous zone and outer fibrocartilagenous zone. This agreed with Junqueira, et al.,1995 who added that in this respect, the structure of the medial meniscus was similar to that of the

intervertebral disc which had in its center an inner cartilaginous zone (nucleus pulposus) resembling the meniscal inner zone. They stated that type I collagen fibers was found in the medial meniscus while the collagen of the nucleus pulposus was type II. They added that the outer fibrocartilage meniscal zone resembled the external annulus fibrosus of the intervertebral disc.

In the present study lacunae showing twin appearance were prominent till the age of 6- months: (21 -24weeks) CRL 20-23cm prenatally and decreased with age progress and were rare in adults. This could be explained by Junqueira, et al.,1995 who mentioned that the interstitial growth occurred only during the early phase of cartilage formation from within. They added that the newly formed chondrocytes synthesized collagen, fibrin and ground substance.

The cartilaginous portion did not show apparent metachromatic staining with toluidine blue. This could be explained by McNicol and Toughley. (1980) who found that the medial menisci possessed considerably less concentration of proteoglycan molecules and glycosaminoglycans than those in cartilage. Also, Adams and Muir (1981) mentioned that the glycosaminoglycan content of the medial meniscus was less than that of the articular cartilage by 8-folds.

In the present work, there was a prominent decrease in the cellular component of both meniscal zones withprobression of age from 7months: (25-28weeks) CRL 24-27cm prenatally till full term. However the collagen bundles became thick and branching. At full term33-36 weeks) CRL 31-34cm), the collagen bundles were arranged mostly parallel in the outer zoneand in a circular manner in the inner zone. In adults the medial meniscus was hypocellular and the collagen bundles were markedly thickened, branching and intersecting parallelly in the outer zone and in a circular manner in the inner zone. This was in agreement with Peterson and Tillman (1999) who mentioned that the major part of the collagen fibers in the central portion of the medial meniscus ran in different directions while in the external portion they were parallel as in tendon tissue. Also, Kummer, (1987) added that the circularly arranged collagen fiber bundles in the inner zone could resist circular stresses. Messner and Gao, (1998) stated that the inner circular and outer parallel arrangement of the collagen bundles of the medial meniscus explained the finding that longitudinal tears could heal and preserve load distribution function of the medial meniscus, while radial or more central and complex tears might heal but did not preserve the load distribution function.

On the other hand Aspeden et al., (1985) who studied the direction of collagen bundles in the adult medial meniscus with x-ray diffraction and polarized microscopy, mentioned that the collagen bundles of the medial meniscus had different directions. While Wagner, (1976) mentioned that collagen fiber of the outer zone outer ran approximately parallel to the outer border, those of the middle zone ran in an arched manner and those of the innermost zone had a radial direction. The marked hypocellularity of the adult medial meniscus made it firm in structure and that was found by Messner and Gao (1998) to be important to make it able to disturbute loads and therefore reduced the stresses on the tibia and was essential for cartilage protection and preservation of osteoarthrosis.

The present work agreed with Standring et al., 2016 who mentioned that medial meniscus was broader posteriorly and was almost a semicircle in shape. It was attached by its anterior horn to the anterior tibial intercondyler area in front of the anterior cruciate ligament; the posterior fibers of the anterior horn were continuous with the transverse ligament of the knee. (when present ). The anterior horn was in the floor of a depression medial to the upper part of the patellar ligament. The poterior horn was fixed to the posterior tibial intercondyler area, between attachment of the lateral meniscus and posterior cruciate ligament. Its peripheral border was attached to the fibrous capsule and the deep surface of the tibial collateral ligament. The tibial attachment of the meniscus was known as the coronary or the meniscotibial ligament. Collectivelly those attachments ensured that the medial meniscus was relatively fixed and moved much less than the lateral meniscus.

However Standring et al., 2016 pointed out that lateral meniscus formed approximately four- fith of a circle and covered a large area than the medial meniscus. Its breads except its short tapering horns was more or less uniform. It was grooved posteriorly by the tendon of popliteus, which separated it from the fibular collateral ligament. Its anterior horn was attached to in front of the intercondyler eminence, posterolateral to the anterior cruciate ligament Its posterior horn was attached behind that eminence in front of the posterior horn of the medial meniscus. Its anterior attachment was contored so that the free margin faced postersuperiorly and the anterior horn rested on the anterior slope of the latertal intercondyler tubercle. Near its 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 to the medial femoral condyle anterior to the posterior cruciate ligament. The meniscofemoral ligamen were often the sole

attachment of the posterior horn of the lateral meniscus

The results of the present work agreed with Standring et al., 2016 who mentioned that two different regions of the menisci had been identified. The inner two thirds of each meniscus consisted of radially organized collagen bundles, and the peripheral one third consisted of large circumferentially arranged bundles (Ghadially et al.,1983). Thinner collagen bundles paralled to the surface of the articular surfaces of the inner part, while the outer portion was covered by synovium. That structural arrangement suggested specific biomechanical functions for the two regions, the inner portion of the meniscus was suited to resting compressive forces while the periphery was capable of resisting tentional forces. With ageing and degeneration, compositional changes occurred within the menisci, which reduced their ability to resist tensional forces. Out ward displacement of the menisci by the femoral condyles was resisred by firm anchorange of the peripheral circumferential fibers of the inter condyler bone of the meniscal horns. The menisci had spread load by increasing the congruity of the articulation, provided stability by their physical presence and proprioceptive feed back, and might cushioned the underlining bone from the considerable forces generated during extreme flexion and extension of the knee.

**5. Conclusion:**

The medial meniscus of 3-months aged fetuses (12-13wks-CRL 8- 9cm)- was primitive in structure. Then they showed an inner cartilaginous zone and outer fibrocartilagenous zone. Then they became hypocellular and collagen content gradually increased. In full term and adults, collagen bundles were circularly arranged in the inner zone and parallel arranged in the outer zone.

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