

GENDER DIFFERENCES IN HUMAN MENISCUS WITH AGE

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INTRODUCTION: Cartilage degeneration is often associated with a degeneration of the meniscal tissue for knee osteoarthritis (OA) patients requiring surgical treatment. While some authors (1,2) have found little or no evidence that degenerative meniscal tears are the cause of osteoarthritis and vice versa, the risk of knee OA following meniscectomy increases with a reported rate of 20 to 40% (3,4). The role of the meniscus as both a shock absorber and stabilizer changes with age. These changes have been studied histologically and biochemically. To understand meniscus degeneration, it is important to study knees with varying degrees of OA. The purpose of this study is to characterize the age-related lesions in meniscus by gross morphological assessment both by region and gender.

MATERIALS AND METHODS: One hundred seventy-seven knees from 89 donors (55 males and 34 females) with an average age of 57 (ranged from 17 to 93) years were obtained. Most of the knee joints were provided by tissue banks as dissected knee blocks. Donor information (e.g. age, gender, body weight, body height, and medical history) was also collected. The knee joints were opened and dissected to fully expose the entire meniscal surface. An image of each meniscus was sketched and assessed in 6 regions: anterior, middle and posterior for both medial and lateral sides by gross morphology. After removal of the meniscus, the articular cartilage was classified using a modified Outerbridge grading system. Meniscal degeneration was correlated with age, cartilage Grade and Bone Mass Index(BMI). Statistical analysis was performed using a Chi-square test and analysis of variance.

RESULTS: Figure 1 shows the relationship between age and meniscal degeneration for both genders. In the male population, a maximum incidence of degeneration is observed by the 40's decade. In subsequent generations, this incidence remains relatively static between 30 and 40%. In the female population, incidence of degeneration occurred later in life with a significant proportion of degeneration seen by the 60's. An increased incidence of meniscal degeneration was observed in this population with increasing age. Figure 2 shows percent of population with meniscus degeneration in each meniscal site for both genders. In males, the most susceptible site for degeneration was the medial posterior region. For the female population, the lateral middle to anterior portion was seen to be most vulnerable to degeneration. The relationship between cartilage OA grade and meniscus degeneration is seen in Figure 3. There is an increasing incidence of meniscal degeneration with increasing (worsening) tibial and femoral cartilage grades. Females tended to have more preserved menisci compared with males even at grades 1 and 2. A significant correlation between BMI and meniscal degeneration was only observed for females over the age of 70 years, figure 4.

DISCUSSION: The results of this study were obtained through gross morphological methods which focus on superficial lesions. The majority of degeneration cases in this study have at least a minor tear. Meniscal degeneration typically begins at the central portion (or substance) of the meniscus. By the time a meniscus is determined to be degenerate by gross morphology, it is already in an advanced state of degeneration. The mechanisms of meniscus degenerative tear are most likely a result of increased high joint load caused by physical activity on denatured and weakened meniscus. These conditions are generally true for young males and puts them at higher risk of meniscal damage. Two reports (5,6) on meniscus injury during sports activity show that males have a much higher injury rate than females and that the medial meniscus is much more vulnerable to tear. These reports support the results of this study which demonstrates that males have high degeneration rates at a young age and the medial posterior region is the most vulnerable in males. The fact that only females over 70 years of age were affected by BMI leads to the conclusion that BMI is a poor predictor of meniscal damage. Roughly half of grade 4 cartilage knees possessed normal menisci. On the other hand in the male population, 1 in 8 knees with meniscal degeneration had a normal grade 1 cartilage. As a result, we can not say whether meniscal degeneration is a cause of OA or not. It is possible that the substance within the meniscus could be denatured and have a reduced capacity as a shock absorber with normal appearance on the surface. This may

alter the mechanics of the knee joint, in turn damaging the cartilage. This has not yet been established.

CONCLUSION: In meniscal degeneration of males the medial posterior region is most vulnerable. The lateral middle to anterior regions appear most vulnerable in females. Males are at a higher risk of meniscal degeneration than females before age sixty. The female population over 70 years of age showed increased degeneration with BMI score.

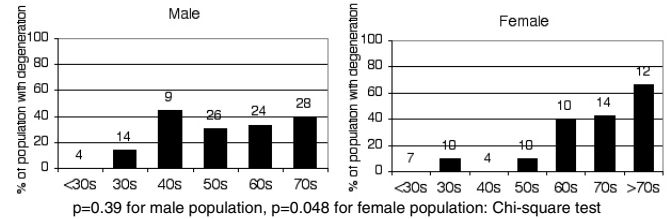


Figure 1: Meniscal degeneration and donors' age. N shown above bars.

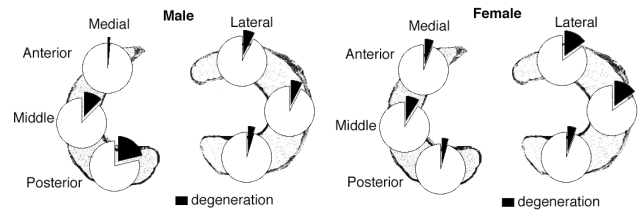
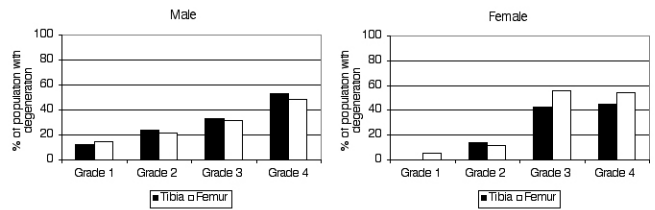


Figure 2: Regional distribution of meniscus degeneration.



p=0.07,0.04 for Tibia and Femur respectively in male population : Chi-square test
p<0.01 for Tibia and femur in female population: Chi-square test

Figure 3: Cartilage OA grade and meniscal degeneration.

(Grade 1-normal, 2-minimal fibrillation, 3-overt fibrillation, 4-erosion)

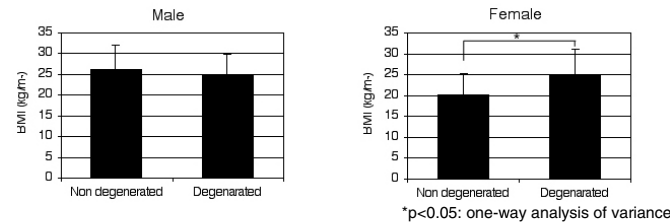


Figure 4: BMI and Meniscus degeneration

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