

Evaluation of symptomatic juvenile discoid meniscus

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INTRODUCTION: Discoid meniscus is a congenital abnormality in which the tissue of the inner rim of the meniscus (generally lateral meniscus) inappropriately covers part or all of the underlying tibial plateau. Discoid menisci are relatively common with an incidence of 3-5% in the general population and up to 10-15% in populations of Asian descent), with both knees affected 15-25% of the time.¹ In juveniles, the inappropriate presence of meniscal tissue in between the joint surfaces can interfere with joint motion and cause pain.¹ Moreover, the discoid meniscus tears much more easily than normal meniscus tissue. In a retrospective study of 1,250 MRIs from young adults (average age 39 years), 71% of patients with discoid meniscus were found to have one or more meniscal tears compared to 54% with normal meniscus.² In the pediatric population, a study of 261 arthroscopies performed for meniscal symptoms in individuals under age 19 found that 75% were discoid, with that number increasing to 97% in the under 13 age group.³ Previous studies reveal that patients with discoid meniscus comprise a substantial proportion of meniscal pathologies in the orthopedic clinic, especially in the pediatric population where discoid meniscus can comprise 75-97% of symptomatic cases. Discoid meniscus also has nearly double the rate of failure after surgical repair with up to 94% of pediatric discoid meniscal patients experience a second tear requiring surgical intervention after the first.⁴ We hypothesize there are fundamental differences in cell and matrix makeup and organization between discoid and normal lateral meniscus.

METHODS: Patients < 18 with symptomatic discoid meniscus or lateral meniscus tear were enrolled in our IRB-approved study. Tissue procured at the time of surgery was utilized for cell isolation/single cell sequencing, histology, biomechanical studies and electron microscopy. A total of 6 patients have been enrolled, 4 discoid meniscus, 2 lateral meniscus tear.

RESULTS: We enrolled tissue from 6 male, 1 female patient, age range 11-18. Meniscus thickness was on average 2.50 ± 0.36 mm in the discoid vs. 1.96 ± 0.12 mm in the normal lateral meniscus (ns, $p=0.352$). H&E staining demonstrated considerable disorganization of the tissue compared to normal lateral meniscus. There was patchy Safranin-O staining in the discoid meniscus without clear organization, along with a "bubbly" appearance to the matrix in contrast to normal meniscus which did not demonstrate any Safranin-O stain. KI67 stain for cell proliferation demonstrated decreased numbers of proliferative cells in the discoid meniscus, especially in the central region.

DISCUSSION: Discoid lateral meniscus demonstrates disorganization of matrix tissue with increased proteoglycan content and decreased numbers of proliferative cells compared to lateral meniscus. Further studies are underway to evaluate whether these changes are developmental or related to abnormal mechanical forces across the discoid meniscus.

SIGNIFICANCE/CLINICAL RELEVANCE: Symptomatic juvenile discoid meniscus has not been extensively studied. We show that the discoid meniscus has significant histologic differences compared to a torn lateral meniscus, which likely represents underlying differences in both tissue formation and tissue function under normal mechanical loads.

REFERENCES:

1. Ahn JH, Kim JH, Wang JH. J Exp Orthop. 2020 Oct 12;7(1):81; PMID: 33044686.
2. Rohren EM, Kosarek FJ, Helms CA. Skeletal Radiol. 2001 Jun;30(6):316-20; PMID: 11465771.
3. Ellis HB Jr, Wise K, LaMont L, Copley L, Wilson P. J Pediatr Orthop. 2017 Jun;37(4):285-292; PMID: 26356314
4. Logan CA, Tepolt FA, Kocher SD, Feroe AG, Micheli LJ, Kocher MS. J Pediatr Orthop. 2021 Sep 1;41(8):496-501; PMID: 34397782.

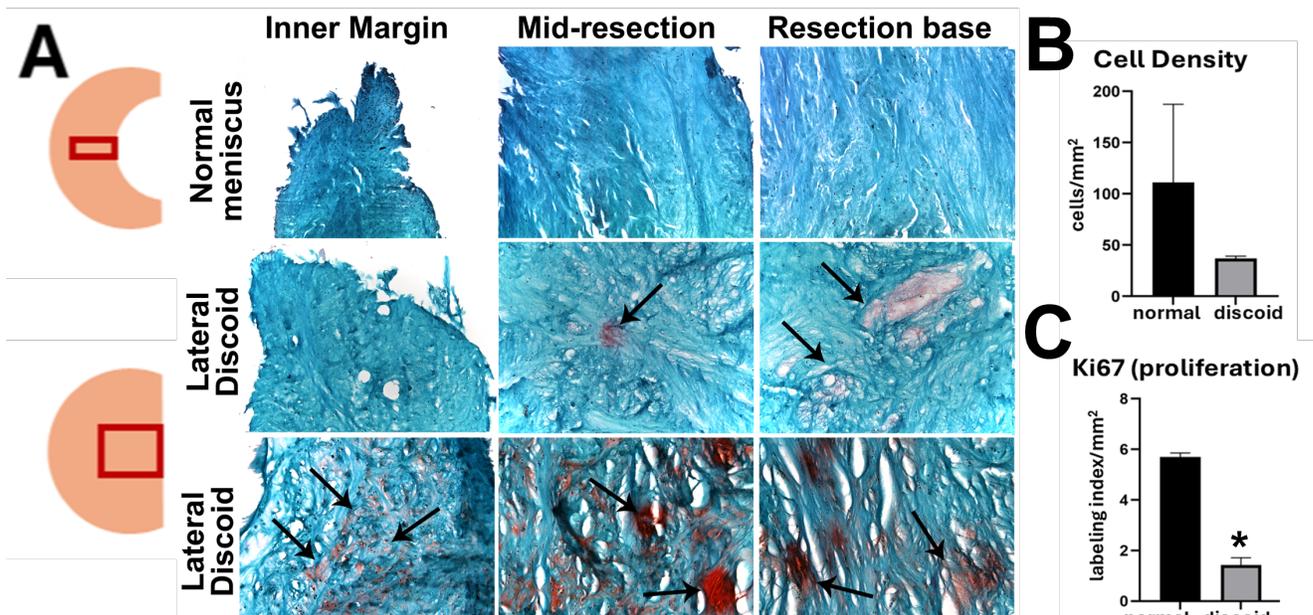


Figure 1: A) Histological findings (Safranin-O Red/Fast Green). Diagrams approximate the area of surgical tissue resection of nondiscoid meniscus tear or discoid tear/saucerization. Tissue from the nondiscoid meniscus displays typical well-organized structure and no Safranin-O stain is detected. In contrast, tissue from discoid meniscus from two different patients is highly disorganized, degenerative, and variable amounts of patchy Safranin-O positive staining are detected. (200x) B) Cell counts reveal a trend toward reduced cell number/mm² (ns, $p=0.399$). C) Ki67 immunostaining and cell counts of labeled cells/total cells reveal a significantly reduced labeling index/mm² in discoid tissue ($p=0.009$).