

# Biomechanical Properties of Meniscal Repair versus Meniscectomy for Horizontal Meniscal Tears

Christian Albert Pearsall, Sohil S. Desai, Christian Edward Athanasian, Dana Peter Piasecki<sup>1</sup>, Bryan Michael Saltzman<sup>2</sup>, Hasani Swindell<sup>3</sup>, David Trofa

<sup>1</sup>OrthoCarolina, <sup>2</sup>OrthoCarolina / Atrium Health Musculoskeletal Inst, <sup>3</sup>Columbia University Irving Medical Center

## INTRODUCTION:

Scant evidence exists describing the biomechanical effects of a meniscectomy or repair following a horizontal meniscus tear (HMT). The purpose of this study is to evaluate the contact mechanics of HMTs following meniscal repair and meniscectomy.

## METHODS:

A PubMed, EMBASE, and CINAHL systematic review was performed on January 16, 2023, including biomechanical studies assessing meniscal tears using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Inclusion criteria were all biomechanical cadaveric studies of HMTs. Studies that did not examine meniscal repairs or meniscectomies, did not report contact area or pressure, involved concomitant injuries (e.g., anterior cruciate ligament tear), were non-biomechanical studies (e.g., review, technique, clinical), and non-English language articles were excluded. Endpoints were peak contact pressure (PCP) and contact area (CA).

## RESULTS:

Out of 1,526 initial results, 6 studies were included for final review. PCP and CA were measured in 59 intact menisci, 59 HMTs, 59 partial meniscectomies (PM), 59 complete meniscectomies (CM), and 33 meniscal repairs. Among all HMTs versus the intact state, pooled PCP increased 14.2%, and pooled CA decreased 7.1%. Among all PMs versus the intact state, 4 studies (67%) found significantly increased PCP (27.1%) and 4 (67%) found significantly reduced CA (22.1%). Among all CMs versus the intact state, 6 studies (100%) found significantly increased PCP (54.5%) and 5 (83%) found significantly reduced CA (33.0%). Three studies directly compared PM to CM, and PM was found to have significantly reduced PCP (27.1% vs. 54.5%) and significantly smaller CA deviation (22.1% vs. 33.0%) from the intact state in 2 studies (67%). Among the three studies evaluating meniscus repair versus the intact state, all found no significant difference in either PCP or CA.

## DISCUSSION AND CONCLUSION:

Meniscal repair is superior to meniscectomy in mitigating alterations in tibiofemoral loading mechanics following a HMT, as the repair group restored contact mechanics to the intact state and demonstrated the smallest deviations from the intact state in pooled PCP and CA among all groups. Direct comparative studies are needed to further evaluate the differences between these treatment strategies.

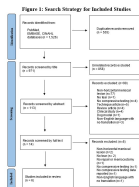


Table 1: Quality of Included Studies as Quantified by AMSTAR Quality Appraisal Tool

Item	Yes	No	Not Applicable
1. A priori definition of the review question	1	0	0
2. A priori definition of the review objectives	1	0	0
3. A priori definition of the review outcomes	1	0	0
4. Identification of all relevant studies	1	0	0
5. Selection of studies based on the review objectives	1	0	0
6. Assessment of the risk of bias in the included studies	1	0	0
7. Synthesis of the data	1	0	0
8. Reporting of the results	1	0	0
9. Registration of the review protocol	1	0	0
10. Funding of the review	1	0	0
11. Conflicts of interest	1	0	0
12. Publication bias	1	0	0
13. Other sources of bias	1	0	0
14. Overall quality	1	0	0

Table 2: Summary of Biomechanical Data

Group	PCP (MPa)	CA (mm²)
Intact	~10	~80
HMT	~14.2%	~-7.1%
PM	~27.1%	~-22.1%
CM	~54.5%	~-33.0%
Repair	~0%	~0%

Table 3: Summary of Statistical Significance

Comparison	PCP Significance	CA Significance
Intact vs HMT	Significant	Significant
Intact vs PM	Significant	Significant
Intact vs CM	Significant	Significant
PM vs CM	Significant	Significant
Repair vs Intact	Not Significant	Not Significant

Table 4: Summary of Study Characteristics

Study	Year	Sample Size	PCP (MPa)	CA (mm²)
1	2015	10	12	75
2	2016	15	15	70
3	2017	20	18	65
4	2018	12	14	72
5	2019	18	16	68
6	2020	14	15	71