

# Incidence, Complication, and Failure Rates of Bucket-Handle Meniscus Tears in Pediatric and Adolescent Population: A Multicenter SCORE Registry Study

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**INTRODUCTION:** Meniscal injuries, notably bucket-handle meniscal tears (BHMT), characterized by displaced meniscal tears, are increasingly common in pediatric populations, attributed to rising sports participation, increased intensity of training, and improved diagnostic tests. Current operative interventions include meniscectomies and repairs, where the preservation via repair is preferred due to increased osteoarthritis risk following meniscectomies. Despite the increasing prevalence, extensive pediatric literature on BHMT is limited. This study leveraged the large multicenter Sports Cohort Outcome Registry (SCORE) to evaluate BHMT incidence, tear characteristics, complication profiles, and repair outcomes.

## METHODS:

A retrospective review of prospectively collected data from the SCORE registry was performed. Patients  $\leq 18$  years undergoing isolated meniscal repairs or concurrent repairs with anterior cruciate ligament reconstruction (ACL-R) with 2-year follow-up were included. Cases with  $< 2$ -year follow-up were excluded. Collected variables included demographics (age, sex, BMI), injury-to-surgery interval, ROM and weight-bearing restrictions, tear characteristics (laterality, location, displacement, vascularity zone), and complications (repair failure, pain, instability, infection, hemarthrosis, arthrofibrosis, flexion loss, extension loss, sensory loss). Complications were also classified into varying severity using the Clavien-Dindo-Sink classification system. Incidence, demographics, characteristics, and outcomes were compared between the non-BHMT repair groups versus the BHMT groups using unpaired t-tests for continuous measures and Chi-square for categorical. Within the BHMT cohort, complication and repair failure rates were compared between isolated meniscus repair and concurrent ACL-R, as well as between medial and lateral BHMTs.

## RESULTS:

Of 1,094 identified meniscal repairs (mean age 14.88 years, 54.0% male), 302 (27.6%) were BHMT. BHMT patients were older (15.05 vs 14.81 years,  $p=0.021$ ), had longer intervals from injury to surgery (112.06 vs 111.49 days,  $p=0.011$ ), shorter durations of ROM restriction (3.56 vs 3.94 weeks,  $p=0.006$ ), and weight-bearing restriction (4.06 vs 4.54 weeks,  $p<0.001$ ). BHMT were less frequently lateral (48.7% vs 61.1%,  $p<0.001$ ) and less common in females (40.7% vs 48.0%,  $p=0.031$ ). The rate of grade II (GII) complications and the rate of grade III (GIII) complications were not statistically different between the BHMT and non-BHMT groups (Table 1). BHMT had a higher incidence of multiple complications (5.9% vs 2.8%,  $p=0.012$ ) (Table 1), extension loss (5.0% vs 2.0%,  $p=0.009$ ), and repair failure (10.6% vs 5.68%,  $p=0.005$ ).

Comparison between isolated meniscus repair within BHMT and concurrent ACLR showed a higher failure rate (17.5% vs 6.4%,  $p=0.002$ ) in the isolated meniscus group, but no statistically significant difference was noted in the GII complication, GIII complications, and multiple complications rate (Table 2). A comparison between medial and lateral BHMT showed no statistically significant difference in GII complications, GIII complications, multiple complications, or repair failure (Table 3).

## DISCUSSION AND CONCLUSION:

This multicenter study provides the largest pediatric BHMT dataset to date, highlighting clinically relevant risk factors and outcomes. BHMT repairs had a higher failure and extension loss compared to non-BHMT, although absolute rates remained low and favorable compared to prior literature. Concurrent ACL-R significantly improved repair outcomes, aligning with existing adult data that indicates enhanced healing environments due to ACL reconstruction. Medial versus lateral BHMT did not affect complication and failure rates. These findings reinforce meniscal repair as the preferred intervention for pediatric BHMT, particularly in conjunction with ACL-R. Future studies should look at long-term follow-up and explore other predictors of outcome, such as surgical technique.

Table 1: Non-BHMT vs BHMT Complication & Failure Rates

Outcome	Complication Status	Non-BHMT (Count, %)	BHMT (Count, %)	p-value
GII Complication	No	698 (72.6%)	264 (87.4%)	0.746
	Yes	94 (11.9%)	38 (12.6%)	
GIII Complication	No	681 (73.1%)	251 (83.1%)	0.232
	Yes	111 (14.0%)	51 (16.9%)	
Multiple Complications	No	770 (97.3%)	284 (94.0%)	0.012
	Yes	22 (2.8%)	18 (6.0%)	
Failed Repair	No	747 (94.4%)	270 (89.4%)	0.005
	Yes	45 (5.6%)	32 (10.6%)	

Table 2: BHMT Isolated Meniscus Repair versus Concurrent ACL-R

Outcome	Complication Status	Isolated Meniscus Repair (n = 114)	ACL-R + Meniscus Repair (n = 188)	p-value
GII Complication	No	99 (86.8%)	165 (87.8%)	0.814
	Yes	15 (13.2%)	23 (12.2%)	
GIII Complication	No	92 (80.7%)	159 (84.6%)	0.384
	Yes	22 (19.3%)	29 (15.4%)	
Multiple Complications	No	108 (94.7%)	176 (93.6%)	0.690
	Yes	6 (5.3%)	12 (6.4%)	
Failed Repair	No	94 (82.5%)	176 (93.6%)	0.002
	Yes	20 (17.5%)	12 (6.4%)	

Table 3: Medial versus Lateral BHMT

Outcome	Complication Status	Medial (n = 155)	Lateral (n = 147)	p-value
GII Complication	No	137 (88.4%)	127 (86.4%)	0.602
	Yes	18 (11.6%)	20 (13.6%)	
GIII Complication	No	127 (82.0%)	124 (84.4%)	0.575
	Yes	28 (18.1%)	23 (15.6%)	
Multiple Complications	No	148 (95.5%)	136 (92.5%)	0.276
	Yes	7 (4.5%)	11 (7.5%)	
Failed Repair	No	137 (88.4%)	133 (90.5%)	0.555
	Yes	18 (11.6%)	14 (9.5%)	