Comparison of Multiligament Reconstruction in Individuals with BMI Over and Under 30

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INTRODUCTION: The purpose of this study was to compare clinical and functional outcomes, including post-operative patient reported outcome measures (PROMs) and complication and revision rates, of multiligament knee reconstruction in individuals with a body mass index (BMI) over versus under 30 kg/m^2 at minimum 2-year follow-up.

METHODS:

A retrospective review was performed to identify all patients who underwent multiligament knee reconstruction between 2001-2022 at a single institution. Individuals were classified further based on whether their body mass index (BMI) was over or under 30 kg/m^2. Exclusion criteria consisted of patients who did not have a reported BMI within 1 year of surgery, or did not undergo multiligament knee reconstruction or repair. Patients were also excluded if the primary surgical procedure analyzed was a revision of a prior multiligament knee injury (MLKI) surgery. Patients who were deceased or underwent a total knee arthroplasty (TKA) prior to final follow-up were excluded from PROM analysis. Medical records were reviewed for demographics, Schenck classification grade (KD), and concomitant injuries (neurologic, vascular, meniscal, and cartilage). Post-operative clinical exam findings and PROMs for each cohort, including Visual Analog Scale (VAS), Tegner activity scale, Lysholm score, and International Knee Documentation Committee Subjective (IKDCs) score, were analyzed and compared. Post-operative complication and revision rates were evaluated and compared. Statistical analyses were performed to compare differences in the clinical outcomes between the two cohorts. Non-parametric continuous variables were analyzed using Wilcoxon rank-sum tests. Categorical variables were analyzed using Pearson chi-square analyses.

RESULTS:

A total of 207 patients were included (**Table 1**). There were 128 patients with a BMI < 30 kg/m^2 (mean age: 27.0 ± 11.3, mean BMI: 25.6 ± 3.1) and 79 patients with a BMI > 30 kg/m^2 (mean age: 32.8 ± 9.5, mean BMI: 37.1 ± 5.8). There were no significant differences between the two cohorts regarding patient sex and knee laterality. The two cohorts also had a similar number of patients with a KD grade of 2, 3, 4, and 5. The mean follow-up was 8.1 ± 4.9 years for the BMI < 30 kg/m^2 cohort and 7.2 ± 4.8 years for the BMI > 30 kg/m^2 cohort (p = 0.229). Patients with a BMI > 30 kg/m^2 had a significantly decreased post-operative range of motion when compared to patients with a BMI < 30 kg/m^2 (p = 0.0002). However, there were no differences in post-operative clinical exam findings between the two cohorts for Lachman, pivot shift, posterior drawer, quadriceps activation test, valgus stress at 0°, valgus stress at 30°, varus stress at 0°, varus stress at 30°, and dial test. There was no difference in terms of concomitant vascular injuries between the two cohorts (p=0.305) (**Table 2**). However, patients with a BMI > 30 kg/m^2 had a significantly increased number of concomitant nerve and cartilage injuries (based on grade 2+ cartilage change), and a significantly decreased number of concomitant meniscus injuries. Patients with a lower BMI (<30 kg/m^2) had statistically significant better post-operative IKDC (67.9 ± 21.2 vs. 76.8 ± 22.2; p = 0.008), Lysholm (75.7 ± 21.0 vs. 81.7 ± 20.7; p = 0.037) and Tegner scores (5.5 ± 2.1 vs. 4.2 ± 1.9; p = 0.005) (**Table 3**). There were no differences between the two cohorts in terms of complications, reoperation rate, or conversion to TKA (p > 0.05 for all).

DISCUSSION AND CONCLUSION: Patients who undergo multiligament knee reconstruction and have a BMI > 30 kg/m^2 demonstrate satisfactory post-operative patient reported outcome measures at a minimum of 2-year follow-up. Increasing BMI did not increase incidence of complication or reoperation following multiligament knee reconstruction. However, their post-operative patient reported outcome measures were significantly decreased when compared to patients with a BMI < 30 kg/m^2.

Table 1: Demographics[a]

Characteristic	BMI < 30 kg/m² (n = 128)	BMI > 30 kg/m² (n = 79)	P value
Age	27.0 ± 11.3	32.8 ± 9.5	**<0.001**
Sex			0.600
Male	95 (74)	56 (71)	
Female	33 (26)	23 (29)	
BMI	25.6 ± 3.1	37.1 ± 5.8	**<0.001**
Laterality			0.292
Right	52 (41)	38 (48)	
Left	76 (59)	41 (52)	
KD Grade			**0.022**
1	64 (50)	22 (28)	
2	9 (7)	4 (5)	
3M	19 (15)	22 (28)	
3L	23 (18)	21 (27)	
4	9 (7)	5 (6)	
5	4 (3)	5 (6)	

[a]Data are expressed as mean ± SD or n (%).
*Includes reconstructions

Table 2: Concomitant Injuries[a]

Characteristic	BMI < 30 kg/m² (n = 128)	BMI > 30 kg/m² (n = 79)	P value
Meniscus	79 (62)	33 (42)	**0.005**
Cartilage	26 (21)	26 (33)	**0.040**
Nerve	20 (16)	26 (33)	**0.003**
Vascular	8 (6)	8 (10)	0.305

[a]Multiple procedures may have been performed at the time of operation.
[a]Data are expressed as n (%).

Table 3: Post-operative Clinical Outcomes[a]

Characteristic	BMI < 30 kg/m² (n = 128)	BMI > 30 kg/m² (n = 79)	P value
Mean Follow-up (y)	8.1 ± 4.9	7.2 ± 4.8	0.229
Range of Motion	126.4 ± 18.9	121.5 ± 13.6	**<0.001**
IKDC	76.8 ± 22.2	67.9 ± 21.2	**0.008**
Lysholm	81.7 ± 20.7	75.7 ± 21.0	**0.037**
VAS Pain			
At Rest	1.1 ± 1.9	1.4 ± 2.1	0.450
With Use	2.4 ± 2.3	2.6 ± 2.7	0.953
Tegner	5.5 ± 2.1	4.2 ± 1.9	**0.005**
Complications	32 (25)	21 (27)	0.800
All-Cause Reoperation	31 (24)	22 (28)	0.561
TKA	4 (3)	5 (6)	0.272

[a]Data are expressed as mean ± SD or n (%).
IKDC-international knee documentation committee; VAS-visual analog scale; TKA-total knee arthroplasty