

Introduction:

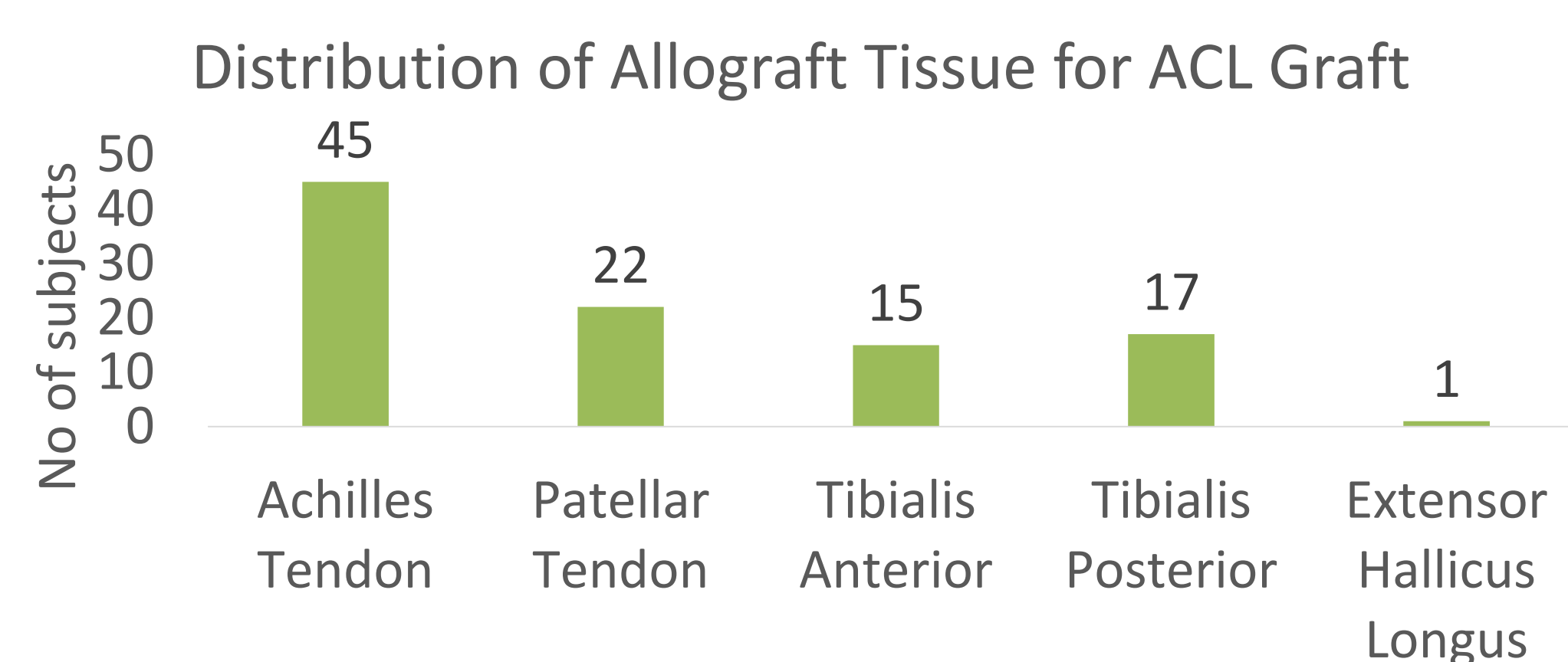
Traditionally, autograft tissue has been the gold standard for anterior cruciate ligament (ACL) reconstruction, however in recent years the use of allograft tissue has increased among orthopaedic surgeons. While it is often reported that irradiated allografts are associated with increased failure rates, there is conflicting evidence for the use of nonirradiated allograft tissue with limited findings in young active patients. This prospective case series investigates the use of nonirradiated fresh frozen allografts in a series of active patients 25 years or less at the time of surgery.

Methods:

Between 2014 and 2015, 1250 ACL reconstructions were performed by 2 surgeons. Of these 100 consecutive subjects ≤ 25 years of age underwent endoscopic ACL reconstruction using a sterile harvested, non-irradiated fresh frozen allograft. At minimum 24 months post surgery, full IKDC knee ligament evaluation and examination was performed including instrumented testing using the KT-1000 arthrometer, IKDC Knee Ligament Evaluation & Lysholm Knee Score. Repeat injuries to either knee were monitored. The relationship between allograft donor characteristics and ACL graft rupture was examined.

Results:

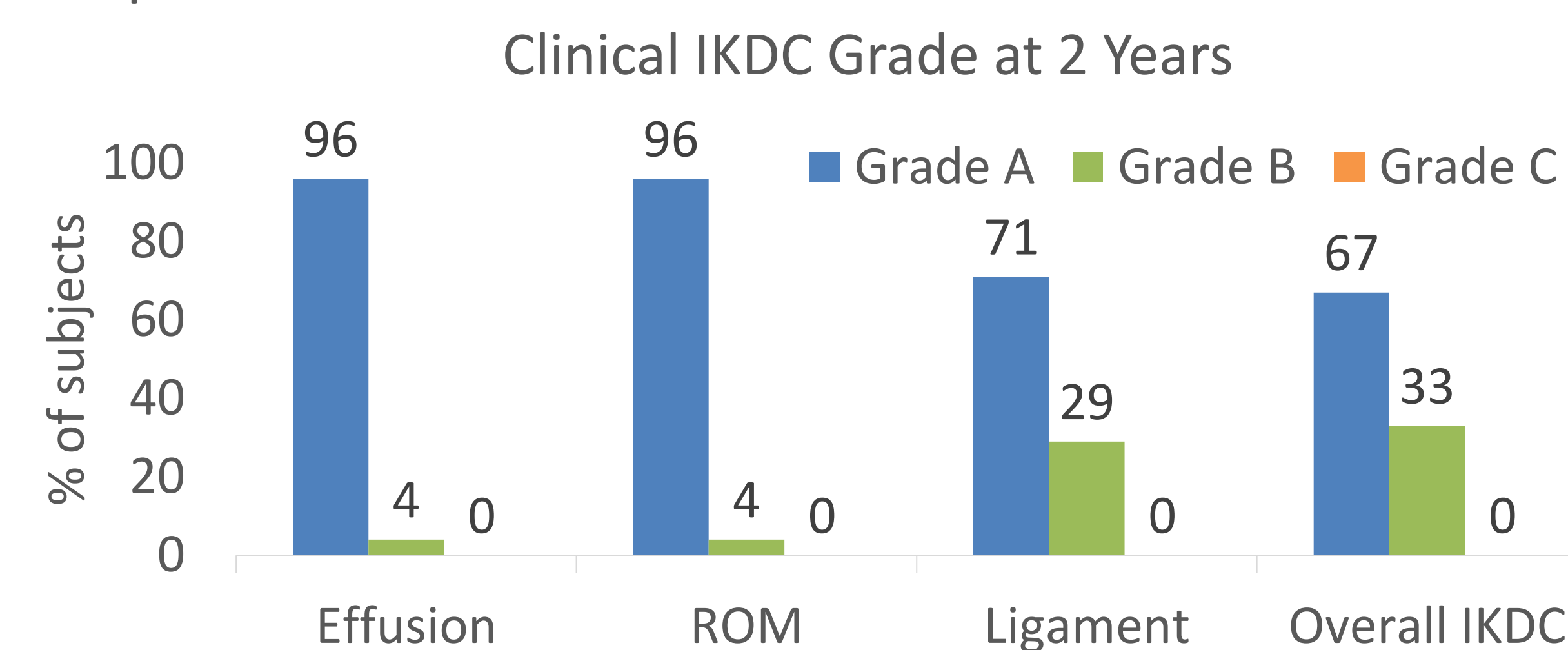
- Of the 100 subjects 90% were followed to 2 years
- 76 were male
- The mean age was 19 years at surgery (range 16-25)
- The mean graft diameter was 9.7mm (range 7-12mm)
- The donor graft was obtained from males in 61%, and the mean donor age was 42 years (18-61 years)
- The donor was aged 50 or more in 42%



- There was no significant difference in the donor age across Allograft Types ($p=0.87$)
- The mean graft diameter was greater in the single band grafts (Achilles or Patellar Tendon, 10.1mm) compared to the multi strand grafts (Tibialis Anterior, Posterior or Extensor Hallicus Longus, 9.0mm), $p=0.001$.

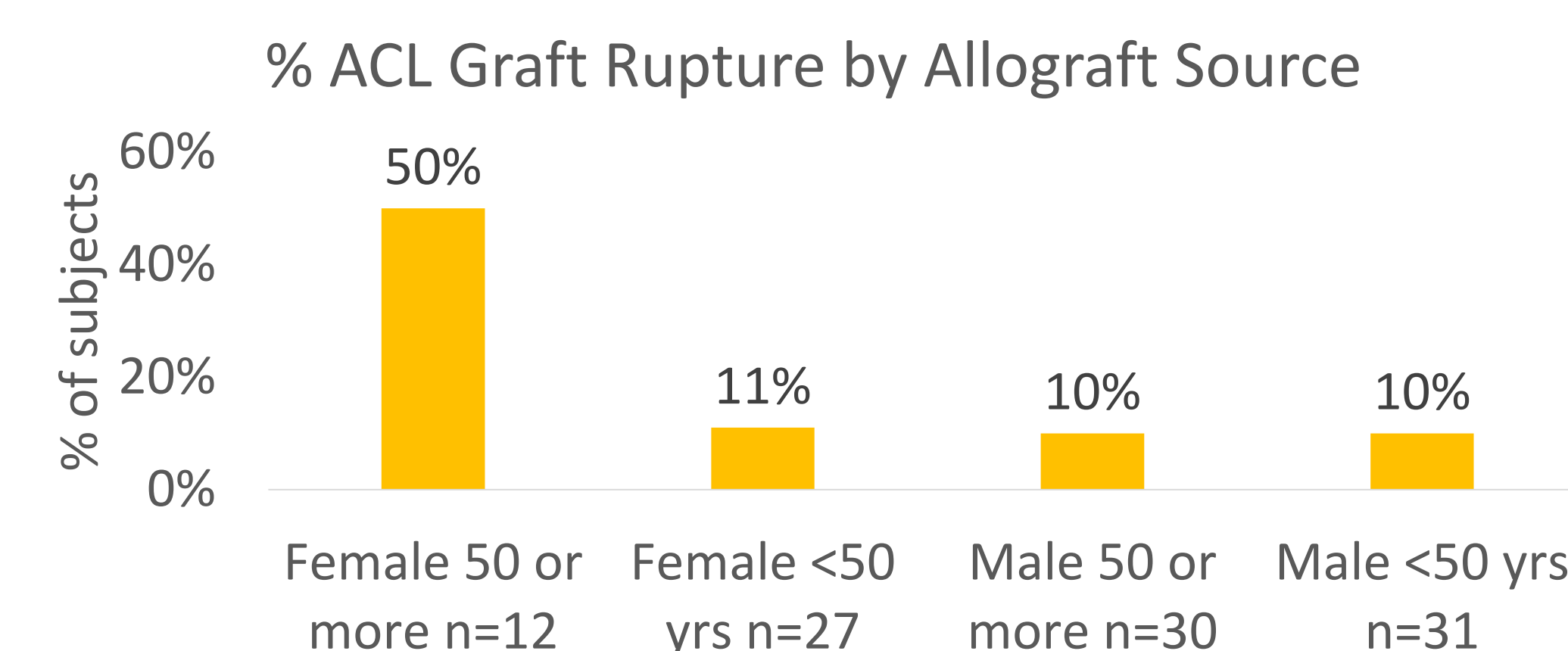
Clinical Results at 2 years

- Of those with intact ACL graft and contralateral ACL the IKDC ligament grade was normal in 67% and nearly normal in 33%
- The mean IKDC subjective score was 91 out of 100
- 92% reported participating in strenuous or very strenuous sports
- 61% reported they had returned to their preinjury level sport

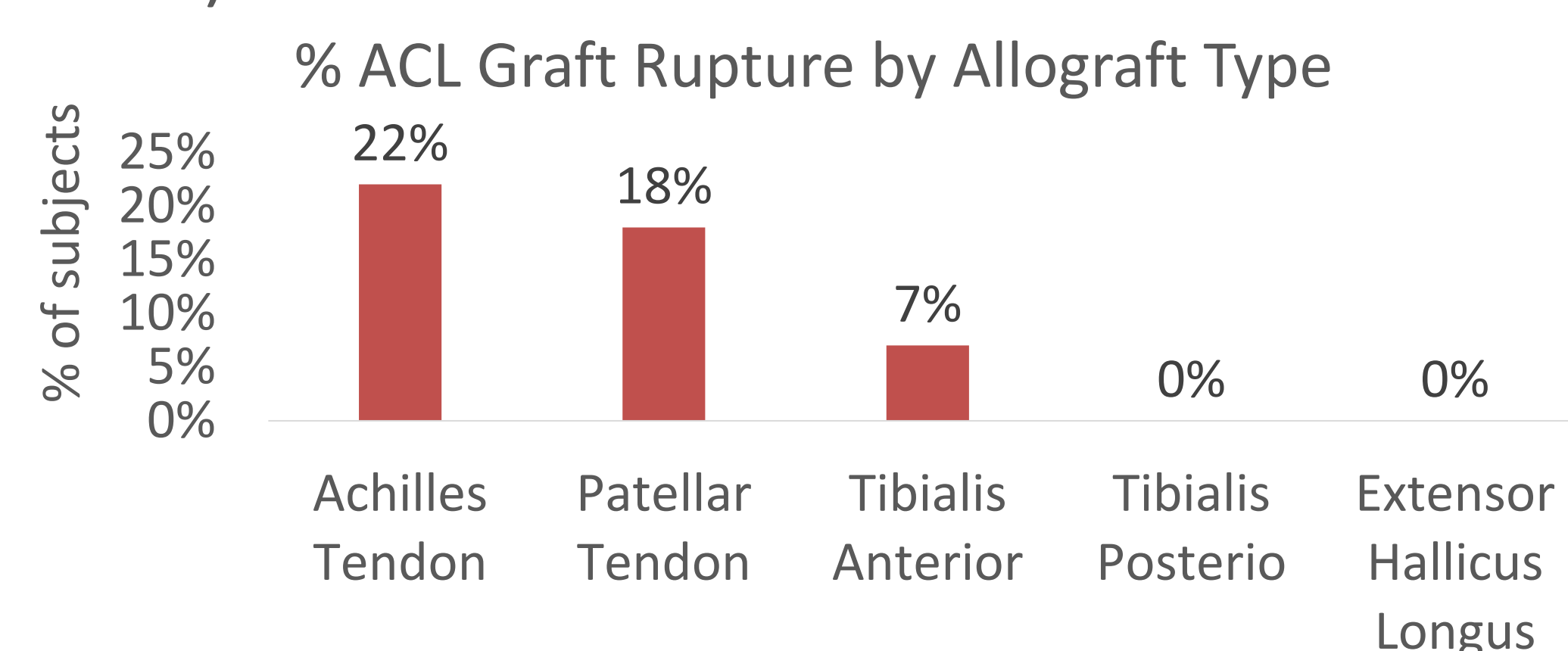


ACL graft rupture

- ACL graft rupture occurred in 15 subjects
- Contralateral ACL rupture occurred in 4 subjects
- ACL graft rupture occurred in 23% of female donor grafts and 10% of male donor grafts ($p=0.07$)
- ACL graft rupture occurred in 10% of grafts from <50 year old donors and 21% of grafts from donors aged 50 or more ($p=0.13$)



- ACL graft rupture rate was significantly higher if the donor was a female over 50 years ($p=0.008$)
- ACL graft rupture occurred in 3% of multi-strand allografts (Tibialis Anterior, Posterior and EHL) and 21% of single strand allografts (Achilles & Patellar Tendon) ($p=0.019$)



- The mean graft diameter was not significantly different between those that had an ACL graft rupture and those with intact ACL graft (mean 9.7 vs 9.7mm, $p=0.90$)
- The allograft donor characteristics of graft type, donor gender, donor age were entered into a stepwise multiple regression model for ACL graft rupture. The significant factors are shown in Table 1.

	N	% Graft Rupture	Odds Ratio	95% CI	p
Donor Graft Type					
Single-Band (Achilles or Patellar)	67	21%	17.7	1.6-191	0.018
Multi-Strand (Tibialis Anterior, Posterior, EHL)	33	3%			
Donor Gender and Age					
Female 50 or more	12	50%	17.8	3.2-100	0.001
Female < 50 years	27	11%			
Male 50 or more	30	10%			
Male <50 years	31	10%			

- The donor grafts were obtained from 2 tissue banks. All grafts are harvested under sterile conditions. Tissue Bank A processed the grafts with a chlorhexidine 0.5% in ethanol 70% wash ($n=75$). Tissue Bank B processed the grafts with 320ug/ml gentamicin in saline ($n=25$). There was no significant difference between the graft rupture rates between Tissue Bank A and Tissue Bank B ($p=0.87$).

Conclusions:

ACL reconstruction with fresh frozen allograft in young active patients was associated with high mean IKDC scores and good ligament stability over 2 years. However, there was high rate of ACL graft rupture (15%) over 2 years.

Despite existing in vitro biomechanical studies demonstrating that the structural properties of allograft are independent of donor age [1], we found that if the allograft donor was female and over 50 years the odds of graft rupture was increased by a factor of 18. There was no corresponding increase in male donors over 50 years.

Additionally a 18x greater odds of ACL graft rupture was seen with single band allografts (Achilles or Patellar Tendon) compared to multi strand soft tissue grafts (Tibialis Anterior, Posterior or EHL).

When fresh frozen donor allograft material is considered for ACL reconstruction we now favor multi-strand soft tissues from male donors, or females under 50 years.

References:

- Greaves LL, Hecker AT, Charles H, Brown J. The Effect of Donor Age and Low-Dose Gamma Irradiation on the Initial Biomechanical Properties of Human Tibialis Tendon Allografts. *Am J of Sports Med* 2008;36(7):1358-66.