Return to Sport After Anterior Cruciate Ligament Reconstruction

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Objective

- Correlate factors assessed at 6 months of ACL reconstruction with a better rate of return to the sport.
- We hypothesize that patients who return to pre-injury sports level achieve better results in multiple tests than patients that do not return to their pre-injury level.

Methods

- Prospective cohort
- 58 patients submitted to ACL reconstruction with different autologous graft types: hamstrings tendons, patellar tendon and quadriceps tendon
- 81.1% male
- Age between15-59 years (mean 35.5 years)

- At 6 months after surgery patients were submitted to:
  - Isokinetic Evaluation
  - Stability Test
  - Video Analysis of Vertical Jump
  - Arthrometry KT-2000
- **Questionnaires:**
  - Tegner
  - IKDC
  - Lysholm

Isokinetic Evaluation

- Strength, power and muscle resistance evaluation
- Considered the “gold standard” for measuring muscle strengh
- Two important aspects to be evaluated after ACL reconstruction:
  - Symmetry index between operated and non-operated limb
  - Relation between hamstrings and quadriceps strength (*H:Q ratio*)

- There is no consensus on values for ACL reconstruction
- Most used values in the literature:
- 70-90% of strength of the operated limb in relation to the non-operated
  H:Q ratio 50-80%

Undheim, Marit Baste, et al. "Isokinetic muscle strength and readiness to return to sport following anterior cruciate ligament reconstruction: is there an association? A systematic review and a protocol recommendation." Br J Sports Med(2015): bjsports-2014.
Czuppon S, Racette BA, Klein SE, et al. Variables associated with return to sport following anterior cruciate ligament reconstruction: a systematic review. Br J Sports Med 2014;48:356–64.
Hewett TE, Di Stasi SL, Myer GD. Current concepts for injury prevention in athletes after anterior cruciate ligament reconstruction. Am J Sports Med 2013;41:216–24.
Kim, Won Kuel, et al. "Reliability and validity of isometric knee extensor strength test with hand-held dynamometer depending on its fixation: a pilot study." *Annals of rehabilitation medicine* 38.1 (2014): 84-93.

Stability Test

- *Biodex Balance System(BBS)*: objectively measures the ability to maintain posture in dynamic stress
  - Uses free circular platform: tilt up tp 20º
  - Calculates indexes: anteroposterior stability, medio-lateral and global stability
  - Represent fluctuations around the zero point previously established
  - Paterno et al .: stability deficit measured by BBS was a predictor of new ACL injury

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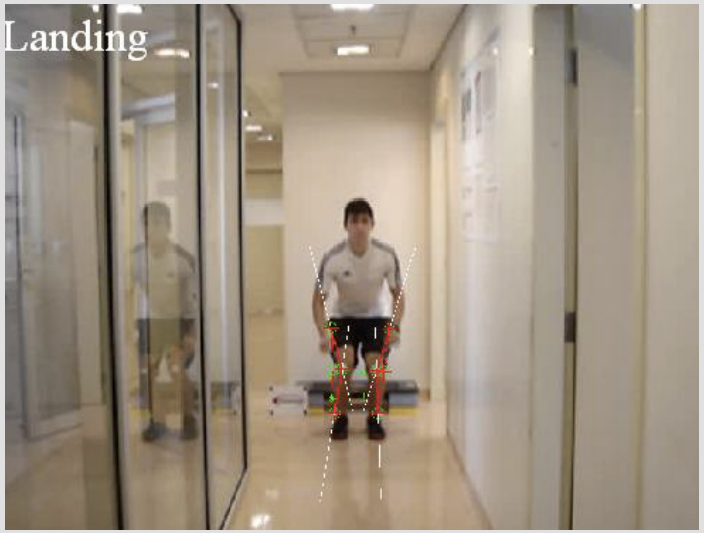
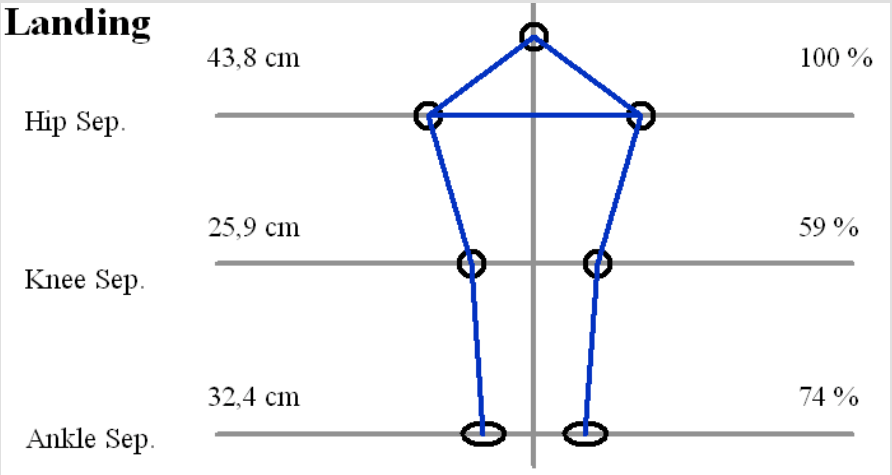
Video Analysis of Vertical Jump

- Drop-Jump Screening Test: analyzes knee positioning during vertical jump phases
- Three images are captured: pre-landing, landing and takeoff
- Value used is the comparison between the separation of the knees relative to the separation of the hips at the end of the landing movement





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Arthrometry Test (KT-2000)

- KT-2000 device : evaluates anterior tibial displacement
- Four measures: 10, 20, 30 pounds and manual maximum
- Normal value more accepted: <3mm difference between the limbs
- Absolute value: high variability among examiners
- Difference value: more reliable
- Graft failure suggested in another study: >5mm

- Studies using post-op arthrometry did not identify direct correlation between higher values and worse functional outcome
- In a systematic review: lack of evidence on this correlation
- Studies in healthy knees: difference between limbs up to 3mm

Daniel, D.M., et al., Instrumented measurement of anterior knee laxity in patients with acute anterior cruciate ligament disruption. Am J Sports Med, 1985. 13(6): p. 401-7.
Grindem, H., et al., A pair-matched comparison of return to pivoting sports at 1 year in anterior cruciate ligament-injured patients after a nonoperative versus an operative treatment course. Am J Sports Med, 2012. 40(11): p. 2509-16.
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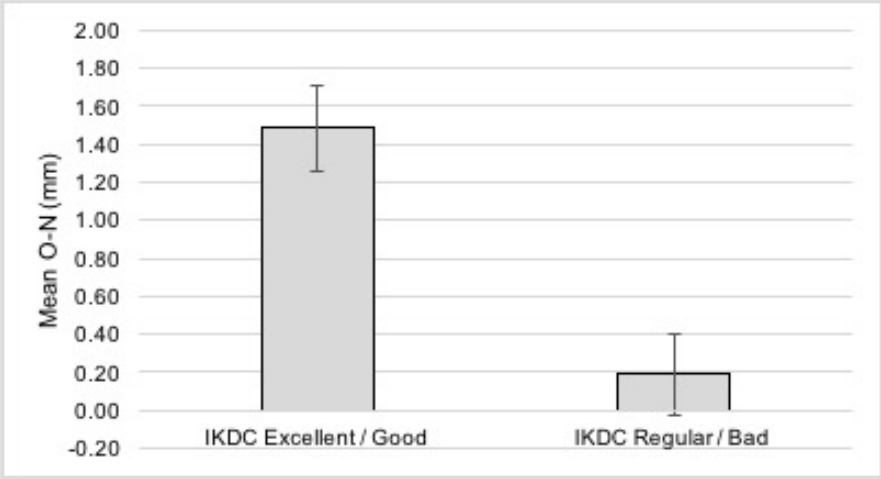
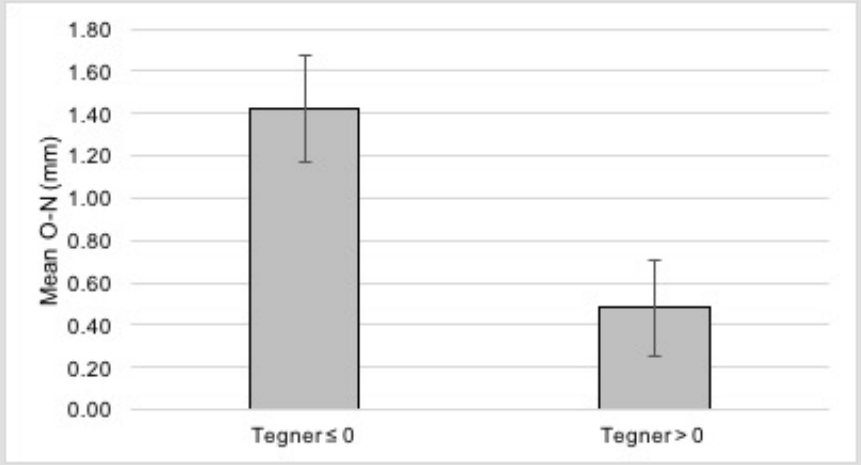
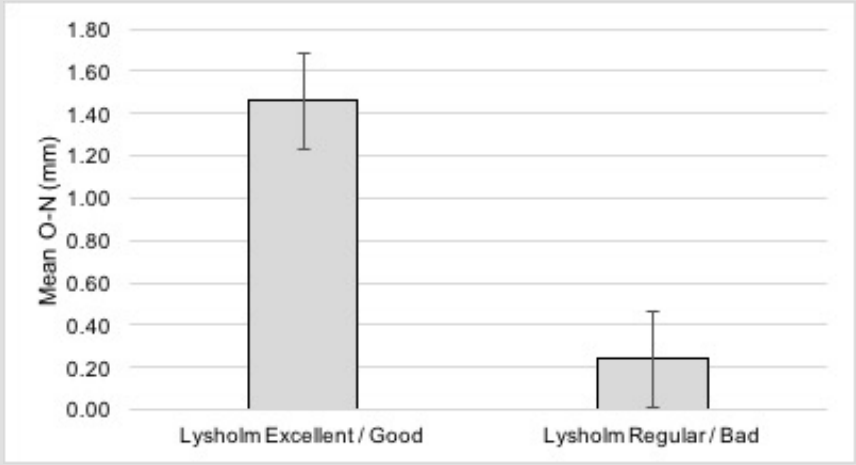
Paterno, M.V., Weed, A. M., & Hewett, T. E., A Between Sex Comparison of Anterior- Posterior Knee Laxity after Anterior Cruciate Ligament Reconstruction with Patellar Tendon or Hamstrings Autograft. Sports medicine, 2012. 42(2): p. 135-152.

Results

- Rate of return to sport: 84.4%
- Rate of return to pre-injury sport level: 53.4%
- Higher return to pre-injury level(Tegner ≤0) Lysholm and IKDC: pacients with higher values at the arthrometry KT-2000 (mean1,01mm, SD=1.4mm)

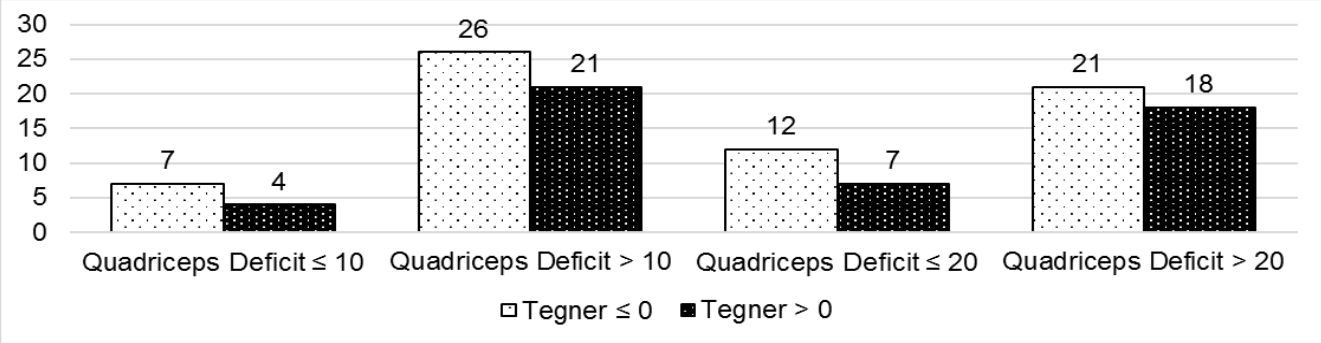






Results

	Quadriceps Deficit ≤ 10 (N=11)	Quadriceps Deficit > 10 (N=47)	p-value	Quadriceps Deficit ≤ 20 (N=19)	Quadriceps Deficit > 20 (N=39)	p-value
Tegner ≤ 0	7	26	0.616	12	21	0.502
Tegner > 0	4	21		7	18	
Lysholm Excellent / Good	10	27	0.044	14	23	0.274
Lysholm Regular / Bad	1	20		5	16	
IKDC Excellent / Good	9	28	0.167	14	23	0.274
IKDC Regular / Bad	2	19		5	16	



	N	Tegner ≤ 0	N	Tegner > 0	p-value
Values		**Mean ± SD**		**Mean ± SD**	
Mean O-N (mm)	33	1.42 ± 1.46	25	0.48 ± 1.12	0.007
Quadriceps PT (Nm)	33	223.32 ± 56.16	25	251.68 ± 51.89	0.054
Quadriceps PT Inv (Nm)	33	163.23 ± 49.46	25	175.85 ± 53.96	0.359
Quadriceps Deficit (%)	33	25.68 ± 17.39	25	29.90 ± 16.00	0.348
Hamstring PT (Nm)	33	117.91 ± 29.91	25	125.94 ± 18.82	0.216
Hamstring PT Inv (Nm)	33	104.69 ± 37.73	25	116.90 ± 23.17	0.135
Hamstring Deficit (%)	33	6.14 ± 15.63	25	7.37 ± 12.65	0.749
Rel Ago/Ant	33	53.49 ± 8.73	25	50.99 ± 7.03	0.246
Rel Ago/Ant Inv	33	69.16 ± 15.24	25	70.57 ± 20.11	0.763
Biodex Balance System	15	-1.07 ± 25.37	11	4.64 ± 29.73	0.603
Sportsmetrics (%)	33	71.94 ± 17.16	25	72.16 ± 17.72	0.962
IKDC	33	83.58 ± 10.59	25	69.76 ± 14.58	2.47×10^{-4}
Lysholm	33	91.58 ± 9.68	25	76.72 ± 15.41	1.43×10^{-4}

Results

- No statistical difference at the rate of return to pre-injury level:
  - Between using cutoff values of quadriceps strength 80 or 90% of the contralateral limb.
  - Video Analysis of Vertical Jump
  - Stability tests
  - Between different graft types

Conclusions

- The deficit of quadriceps strength, regardless of the used cutoff value, 80 or 90%, did not predict the return to the pre-injury sports level, at the 6 months post-op evaluation.

- Higher anterior tibial displacement of the operated limb compared to the non-operated, although < 3mm, showed higher values of activity level (Tegner) and functional questionnaires (IKDC and Lysholm).

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