

The Association of Strength and Balance with Functional Outcomes in Patients with ACL Reconstruction

Dr. Patrick Pabian, PT, DPT, SCS, OCS, CSCS
John Boyd, SPT
Victor DeRosa, SPT
Roman Makarov, SPT
Dr. Eric Greeno, PT, DPT, SCS, CSCS

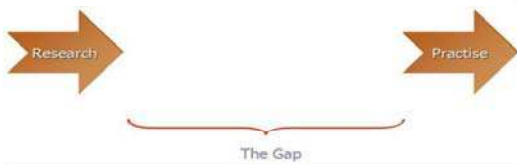


University of Central Florida
Doctor of Physical Therapy Program

Introduction

- 120,000 ACL injuries per year
- 40%-50% of all ligamentous knee injuries
- ACL reconstruction surgery costs
 - Approximately \$1 billion per year
- 18% re-injury rate
- Kinesiophobia
- Implications¹⁻⁴

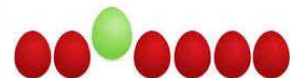
Introduction (cont.)



- Reliable assessment of function
- Quantify function
- Strength and weight distribution vs. self-assessment

Methods

- Retrospective
 - Mean age: 20.9 years (\pm 4.7)
 - Gender: 8 males, 9 females
- Inclusion
- Exclusion



Methods

- Instrumentation
 - Biodex Balance System
 - Isokinetic Dynamometer
 - 2000 International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form

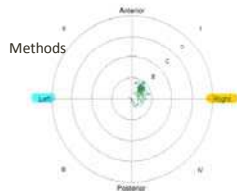
Methods

- Balance Indices & Sway
 - 1 trial
 - 90° squat
 - Blinded visual feedback



Postural Stability Test Results

Program	Station	Subj	Protocol	Side
[Redacted]	Static	SUB	Balance EO	Left
Actual Score				
Overall	2.2	2.0		
Medial Lateral Index	2.2	2.0		
% Time in Zone				
	A	B	C	D
% Time in Zone	100%	0%	0%	0%



- Postural Stability Testing
- Postural stability overall score
 - Postural stability standard deviation
 - Medial lateral index actual score
 - Medial lateral index standard deviation score

Methods

- Strength Testing
 - Sportsmed120 used by OSM
 - 5 minute bike warm-up/stretching
 - Warm-up 25%, 50%, 75% of perceived maximal effort
 - 120°, 15reps, 0-105° to measure total work and fatigue assessment
 - 3 minute rest between sets and extremities tested

Comprehensive Evaluation

[Redacted] [Redacted] [Redacted] [Redacted]
 [Redacted] [Redacted] [Redacted] [Redacted]
 [Redacted] [Redacted] [Redacted] [Redacted]

Patient: [Redacted] [Redacted] [Redacted] [Redacted]
 Pattern: [Redacted] [Redacted] [Redacted] [Redacted]
 Music: [Redacted] [Redacted] [Redacted] [Redacted]
 Construction: [Redacted] [Redacted] [Redacted] [Redacted]

Date: [Redacted] [Redacted] [Redacted] [Redacted]
 Time: [Redacted] [Redacted] [Redacted] [Redacted]

EXTENSION **FLEXION**
100 DEG/SEC **100 DEG/SEC**

# OF REPS/10	100	200	300	400	500
100	100.0	100.0	100.0	100.0	100.0
200	100.0	100.0	100.0	100.0	100.0
300	100.0	100.0	100.0	100.0	100.0
400	100.0	100.0	100.0	100.0	100.0
500	100.0	100.0	100.0	100.0	100.0
600	100.0	100.0	100.0	100.0	100.0
700	100.0	100.0	100.0	100.0	100.0
800	100.0	100.0	100.0	100.0	100.0
900	100.0	100.0	100.0	100.0	100.0
1000	100.0	100.0	100.0	100.0	100.0

Involved-to-uninvolved strength deficit

Strength deficit calculated as:

- Peak torque deficit
- Peak torque to body weight deficit
- Total work deficit
- Total work-to-body weight deficit

Methods

- Self-perceived functional ability (IKDC)
 - Assess 18 areas of function
 - Low scores represent low level of function
 - High scores represent high level of function

IKDC Subjective Knee Evaluation Form

Page 1 of 2008 IKDC SUBJECTIVE KNEE EVALUATION FORM

Name: [Redacted] [Redacted] [Redacted] [Redacted]
 Patient ID: [Redacted] [Redacted] [Redacted] [Redacted]

INSTRUCTIONS:

- What is the highest level of ability you can perform in this sport?
 - Circle the number that best describes the frequency or severity of your problem.
 - Light circles: No walking, kneeling or any activity.
 - Dark circles: Unable to perform any of the activities listed on this page.
- Ranking the IKDC (0-100):
 - 0 = Worst possible
 - 100 = Best possible
- What is the highest level of ability you can perform with significant walking or running?
 - Circle the number that best describes the frequency or severity of your problem.
 - Light circles: No walking, kneeling or any activity.
 - Dark circles: Unable to perform any of the activities listed on this page.
- Ranking the IKDC (0-100):
 - 0 = Worst possible
 - 100 = Best possible

FUNCTION:

Circle the number that best describes the frequency or severity of your problem.

Light circles: No walking, kneeling or any activity.

Dark circles: Unable to perform any of the activities listed on this page.

Methods

- Statistical analysis
 - Pearson's r correlation
 - IKDC correlation with Balance Indices & stability
 - Strength correlation with balance
 - IKDC correlation with strength
 - Association of strength with time on involved/uninvolved limb
 - Hierarchical regression

Results

- IKDC correlation with Balance Indices & stability
- No statistical significance

Correlations

		IKDC score	Postural Stability Overall Score	Postural Stability Std Dev	Medial Lateral Index Actual Score
IKDC score	Pearson Correlation	1	-.082	-.079	-.057
	Sig. (2-tailed)		.753	.764	.827
	N	17	17	17	17

** . Correlation is significant at the 0.01 level (2-tailed).

Results

- Strength correlation with balance
- No statistical significance

		Peak Torque Deficit	Peak Tq/BW Deficit	Total work Deficit	Postural Stability Overall Score	Postural Stability Std Dev	Medial Lateral Index Actual Score	Medial Lateral Index Std Dev
Peak Torque Deficit	Pearson Correlation	1	.087*	.130*	.178*	-.054	.069	-.133
	Sig. (2-tailed)		.287	.190	.107	.619	.791	.610
	N	17	17	17	17	17	17	17
Peak Tq/BW Deficit	Pearson Correlation	.087*	1	.082*	.067*	-.006	.124	-.050
	Sig. (2-tailed)	.287		.290	.300	.981	.635	.602
	N	17	17	17	17	17	17	17
Total work Deficit	Pearson Correlation	.130*	.082*	1	.084*	-.054	.181	-.151
	Sig. (2-tailed)	.190	.290		.108	.619	.633	.672
	N	17	17	17	17	17	17	17
Total work/BW Deficit	Pearson Correlation	.087*	.067*	.084*	1	-.063	.117	-.160
	Sig. (2-tailed)	.287	.300	.108		.619	.655	.695
	N	17	17	17	17	17	17	17

Results

- Strength correlation with balance (cont.)
- No statistical significance

		Peak Torque Deficit	Peak Tq/BW Deficit	Total work Deficit	Total work/BW Deficit	Postural Stability Overall Score	Postural Stability Std Dev	Medial Lateral Index Actual Score	Medial Lateral Index Std Dev
Postural Stability Overall Score	Pearson Correlation	-.082	-.086	-.054	-.063	1	.098*	.027	-.041
	Sig. (2-tailed)	.287	.281	.318	.315		.600	.917	.877
	N	17	17	17	17	17	17	17	17
Postural Stability Std Dev	Pearson Correlation	.098*	.096*	.054	.063	.098*	1	.138	.122
	Sig. (2-tailed)	.271	.275	.686	.655	.686		.597	.641
	N	17	17	17	17	17	17	17	17
Medial Lateral Index Actual Score	Pearson Correlation	-.041	-.050	-.151	-.160	-.027	-.138	1	.084*
	Sig. (2-tailed)	.610	.649	.563	.539	.917	.597	.602	
	N	17	17	17	17	17	17	17	17
Medial Lateral Index Std Dev	Pearson Correlation	.027	.026	.041	.041	-.041	.122	.084*	1
	Sig. (2-tailed)	.919	.902	.872	.895	.877	.641	.602	
	N	17	17	17	17	17	17	17	17

** . Correlation is significant at the 0.01 level (2-tailed).

Results

- IKDC correlation with strength
- Statistical significance

Correlations

		IKDC score	Peak Torque Deficit	Peak Tq/BW Deficit	Total work deficit	Total work/BW deficit
IKDC score	Pearson Correlation	1	.043	.041	.005	.008
	Sig. (2-tailed)		.005	.008	.005	.041
	N	17	17	17	17	17

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Results

- Association of strength with time on involved/uninvolved limb
 - Statistical significance

Correlations

		Peak Torque Deficit	Peak Tq/BW deficit	Total work deficit	Total work/BW deficit	Time spent on involved limb	Time spent on uninvolved limb
N		17	17	17	17	17	17
Time spent on involved limb	Pearson Correlation	.656*	.680*	.634*	.601*	1	-1.000*
	Sig. (2-tailed)	.023	.003	.006	.011	.000	.000
N		17	17	17	17	17	17
Time spent on uninvolved limb	Pearson Correlation	.549*	.680*	.634*	.601*	-1.000*	1
	Sig. (2-tailed)	.023	.003	.006	.011	.000	.000
N		17	17	17	17	17	17

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

Results (cont.)

- Prediction of IKDC with strength and balance weight shift measures

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	Total work/BW deficit, Peak Tq/BW deficit ^a		Enter
2	Time spent on involved limb ^b		Enter

a. Dependent Variable: IKDC score
 b. All requested variables entered.

Model Summary

Model	R	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
				F Change	df1	df2	Sig. F Change
1	.639*	.524	9.27196	4.826	2	14	.023
2	.653*	.293	9.68075	.403	1	13	.037

a. Predictors: (Constant), Total work/BW deficit, Peak Tq/BW deficit
 b. Predictors: (Constant), Total work/BW deficit, Peak Tq/BW deficit, Time spent on involved limb

Results (cont.)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	866.009	2	433.004	4.826	.023
	Residual	1256.052	14	89.718		
	Total	2122.061	16			
2	Regression	903.740	3	301.247	3.214	
	Residual	1218.321	13	93.717		
	Total	2122.061	16			

a. Dependent Variable: IKDC score
 b. Predictors: (Constant), Total work/BW deficit, Peak Tq/BW deficit
 c. Predictors: (Constant), Total work/BW deficit, Peak Tq/BW deficit, Time spent on involved limb

Results (cont.)

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	95.233	7.899			12.056	.000
	Peak Tq/BW deficit	-126.068	65.098	-.946		-1.937	.073
	Total work/BW deficit	31.053	42.301	.359		.734	.475
2	(Constant)	102.672	14.235			7.213	.000
	Peak Tq/BW deficit	-144.563	72.637	-1.085		-1.990	.061
	Total work/BW deficit	32.475	43.292	.375		.750	.461
	Time spent on involved limb	-6.263	9.871	-.182		-.635	.527

a. Dependent Variable: IKDC score

Discussion

- Significant results
- Validity
- Novel
- Limitations

Thank you

- Dr. Eric Greeno, PT, DPT, SCS, CSCS
- Dr. Patrick Pabian, PT, DPT, SCS, OCS, CSCS
- Orlando Orthopaedic Center

References

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