

RELATIONSHIP BETWEEN NEUROCOGNITIVE REACTION TIME AND INCIDENCE OF CORE OR LOWER EXTREMITY SPRAIN OR STRAIN

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BACKGROUND AND PURPOSE

- The relationship between neuromuscular factors and injury susceptibility is currently a focus of prevention research
- Prolonged reaction time (RT) may be a factor that increases susceptibility to sprains and strains
 - Errors in judgment or in a loss of coordination during complex movement patterns are likely causes of injury
- Slower ImPACT™ RT has been shown to be associated with non-contact anterior cruciate ligament (ACL) injuries¹
- ImPACT™ neurocognitive testing has been shown to be a reliable method to examine RT²
- Incidence of lower extremity (LE) injury is greatest among sports that involve contact or a high jump rate³
- The purpose of this study was to examine the relationship between ImPACT™ RT and core or LE sprain or strain for athletes participating in high-risk sports for the occurrence of such injuries

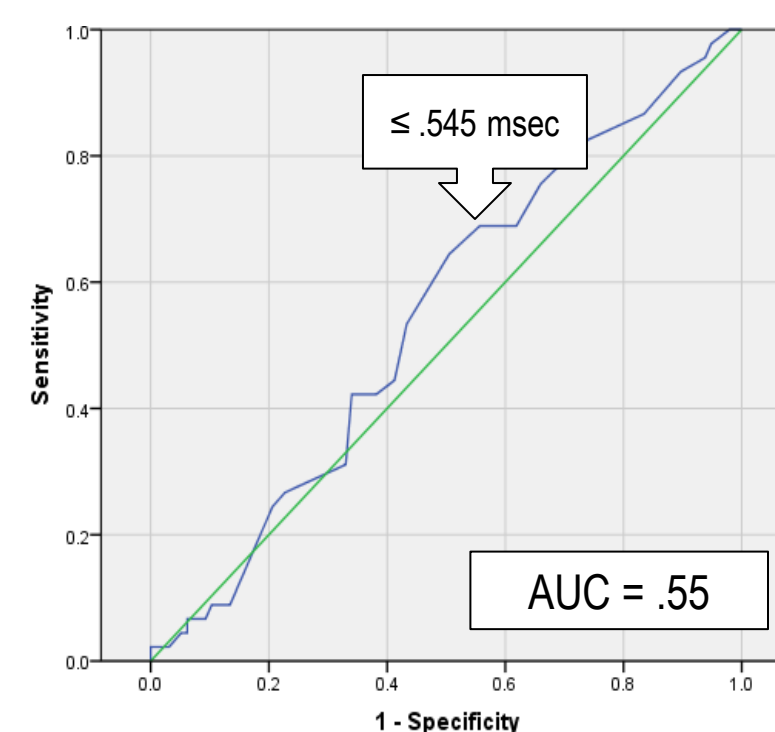
SUBJECT CHARACTERISTICS

- 142 intercollegiate student-athletes participated in this study from 5 different high-risk sports
 - Men's basketball (14), women's basketball (14), football (82), women's soccer (19), & women's volleyball (13)
 - 96 Males: 19.8 ± 1.5 yrs; 1.8 ± .08 m; 99.40 ± 18.6 kg
 - 46 Females: 19.2 ± 1.1 yrs; 1.7 ± .10 m; 69.38 ± 13.3 kg
- Exclusion criterion: student-athletes who did not complete ImPACT™ test and all joint function surveys

Table 1. Descriptive Statistics

Variable	Mean ± SD
FAAM	98.34 ± 4.48
IKDC	94.12 ± 10.69
ODI	2.15 ± 3.40
RT (msec)	0.58 ± 0.08

Figure 1. Reaction Time ROC Curve



METHODS

- ImPACT™ neurocognitive testing and joint function surveys completed prior to initiation of season
 - Foot and Ankle Measurement - Sport Subscale (FAAM)
 - International Knee Disability Committee Knee Survey (IKDC)
 - Oswestry Disability Index (ODI)
- An electronic injury documentation system was used to record all sport-related injuries throughout the season
 - Injury defined as acute core or LE sprain or strain that resulted in at least one day of lost participation
- Receiver operating characteristic (ROC) analysis utilized to dichotomize predictor variables
 - Univariable analyses performed to assess predictive power of each variable individually
 - Fisher's exact test, odds ratio (OR), and relative risk (RR)
- Logistic regression analysis utilized to identify the strongest set of predictors
 - ROC analysis utilized to determine number of positive factors providing optimal discriminatory power

RESULTS

- Means and SD for predictor variables presented in Table 1 and results of univariable analyses presented in Table 2
 - Gender did not demonstrate an association with injury risk ($p = .183$)
 - ROC curve for ImPACT™ RT presented in Figure 1
- FAAM, RT, and IKDC comprised the strongest set of predictive factors for core or LE sprain or strain (Table 3)
 - An athlete with any 1 of the 3 risk factors possesses elevated risk (OR = 4.17; RR = 2.19)
 - Athletes with all 3 risk factors possess greatest risk for core or LE sprain or strain occurrence (Figure 2, Table 4)

Table 2. Results of Univariable Analyses

Variable	Cut-Point	Sn	Sp	OR	RR
FAAM	≤ 95.50	.23	.11	2.62	1.81
IKDC	≤ 98.54	.52	.40	1.68	1.42
RT	≤ .545	.69	.44	1.76	1.49
ODI	≤ 2.00	.46	.61	1.33	1.21

Table 3. Logistic Regression Result

Factor	Cut-Point	Adj OR
FAAM	≤ 95.50	2.30
RT	≤ .545	1.85
IKDC	≤ 98.54	1.17

Figure 2. 3-Factor vs. 1-Factor Model

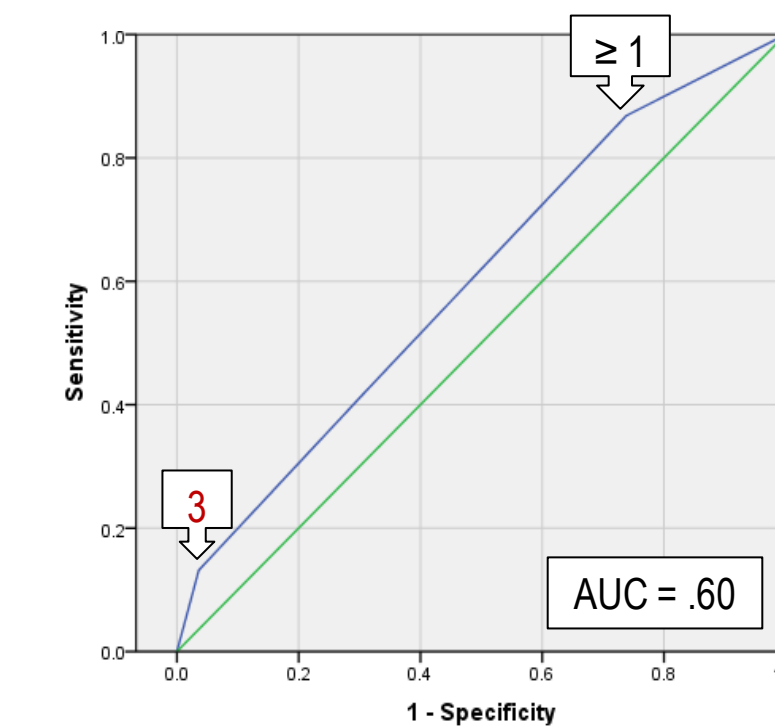


Table 4. 3-Factor Model

3-Factor Model		
Positive Factors	Injury	No Injury
All 3 Factors	5	3
0- 2 Factors	33	81
Total	38	84
Fisher's Exact One-Sided: $p = .061$		
Sensitivity = .13		Specificity = .96
+LR = 3.68		-LR = .90
OR = 3.68 / .90 = 4.09		RR = .625 / .290 = 2.16
90% CI: 1.17 - 14.25		90% CI: 1.30 - 3.60

Table 5. Comparison of Risk Factors

Risk Factors	1	2	3
0	OR: 2.08	OR: 2.10	OR: 7.33
	RR: 1.73	RR: 1.75	RR: 3.38

Table 6. Injury Incidence for Number of Risk Factors

Risk Factors	Injury	No Injury	Incidence
0	5	22	18.5%
1	17	36	32.1%
2	11	23	32.4%
3	5	3	62.5%

CONCLUSIONS

- Neurocognitive RT testing is an important predictor of core or LE sprain or strain for high-risk sport athletes
- The combination of joint function survey scores with RT provides strong predictive power (Tables 4-6)
 - An athlete with any 1 of the 3 risk factors has 2 X greater odds of sustaining injury than an athlete with none
 - An athlete with all 3 risk factors has 7 X greater odds of sustaining injury than an athlete with none
- ImPACT™ neurocognitive testing and joint function surveys should be included in pre-participation assessment to identify athletes who possess elevated risk for injury occurrence
- Further research is needed to determine the extent to which training may improve neurocognitive RT, thereby reducing risk for core or LE sprain or strain

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