Reliability of a Screening Tool to Prevent Running Injuries
The RunningSmart Tool

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Abstract: The goal of this research was to assess inter- and intra-rater reliability of the RunningSmart screening tool, developed to determine weak-links at baseline in novice, recreational and athlete runners. The tool provides a selection of exercises targeting the identified weak-links. Overall, the tool had a fair to good inter- and intra-rater reliability for the separate clinical tests based on the kappa value. The RunningSmart Tool focusses mainly on recreational runners or people that initiate running. Therefore the tool is designed in a practical and easy to apply way that can be used in a clinical setting. These data indicate that the RunningSmart Screening tool can be confidently applied by trained individuals and used to assess the movement patterns of recreational start-to-runners in order to make decisions related to interventions to decline the injury risk and enhance physical activity.

1 OBJECTIVES

In the last decade, running gained popularity as a readily accessible recreational sport and leisure. It is estimated that 10%-20% of Americans run regularly as it is considered to be the most efficient way to achieve fitness (Fields et al., 2010).

In Belgium, many novice untrained runners participate in a start-to-run program in an attempt to resume physical activity. It is a 10 weeks programme that should be continued after. However, a drop-out of 31,5% was reported after 10 weeks. Moreover, 40% of the participants reported an injury (Cloes and Pétré, 2012).

An injury due to running is a capital reason to renounce a running program. In literature, incidence rates of 19,4% to 79,3% were reported (van Gent et al., 2007).

In a healthy active adult population the most frequently reported lower extremity injuries were hamstring strain, anterior cruciate ligament injury, Achilles tendon pathology and ankle sprain (Zazulak et al., 2007). Authors state that a previous injury is the greatest risk factor for future injury caused by changes in proprioception, decreased mobility, increased flexibility, etc.(Fulton et al., 2014) These biomechanical factors are modifiable in order to decrease the initial risk on an injury.

General biomechanical screening tools such as the Functional Movement Screen (Minick et al., 2010, Teyhen DS, 2012) and the Nine-test Screening Battery (Frohm et al., 2012) were suggested in literature and were stated to be reliable. However, these tools were developed to screen athletes.

RunningSmart is a new clinical and biomechanical screening tool developed to determine individual weak-links at baseline in novice, recreational and athlete runners. Based on the outcome of the screening, the tool provides a selection of exercises targeting those identified weak-links in order to reduce the drop-out ratio. The aim of this study was to assess the inter- and intra-rater reliability of the RunningSmart tool.

2 METHODS

2.1 Description of the Tool

A questionnaire was implemented in order to screen for exercise limiting pathologies.

The screening tests for running injuries described

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in the tool are scientifically grounded universal clinical tests to investigate biomechanical and musculoskeletal disorders. An overview of these test is given in Table 1.

Table 1: Overview of the implemented clinical tests.

Test 1	Inspection and Palpation
Test 2	Single Leg Squat
Test 3	Single Leg Jump
Test 4	Single Leg Heel Raise
Test 5	Foot Mobility
Test 6	M. Gluteus Medius Strength
Test 7	Mm. Hamstrings Length
Test 8	Abdominal Strength
Test 9	Mm. Hamstrings or Mm. Glutei Dominance
Test 10	Mm. Quadriceps Length
Test 11	Bridging
Test 12	Iliotibial Tractus Length
Test 13	Hip Mobility

2.2 Protocol

Eligibility criteria for the subjects were (1) 18-25 years old, (2) healthy, (3) BMI 18,5-24,9 kg/m² (male) or 17,5-23,9 kg/m² (female), (4) no biomechanical physical injury in the past (5) performed no severe physical activity 48 hours before measurement, (6) not pregnant.

Both raters (A and B) were physiotherapists and had the same clinical experience and education.

At first, participants were tested randomly by assessor A or B, immediately followed by a retest (the other assessor) to compare inter-rater reliability.

After seven days, all participants were tested again by assessor B to compare intra-rater reliability.

The outcome of the movement evaluation criterion for each test was evaluated by three categorical observational possibilities e.g. "yes", "no" or "more or less".

The ethics committee of the University Hospital in Antwerp approved the trial, and a written informed consent was obtained for each participant.

2.3 Statistical Analysis

The reliability of the overall final score was evaluated using the Interclass Correlation Coefficient (ICC) in SPSS 22.0 (Statistical Package for the Social Sciences, IBM Corporation, NY, USA).

The reliability of each clinical test was analysed by the Cohen's Kappa with a 95% Confidence Interval (95%CI). Given the paradox of high agreement and low Kappa values (Cicchetti and Feinstein, 1990), the positive Proportion of Agreement (PoA) and 95%CI was also calculated in the Excel spreadsheet.

3 RESULTS

Twenty-nine participants met the afore mentioned inclusion criteria (male (n=15; 22,8 kg/m²) and female (n=14; 20,3 kg/m²)).

Overall ICC scores for inter- and intra-rater reliability were 0.652 and 0.686 respectively.

The inter-rater and intra-rater reliability results for the individual clinical tests, are listed in Table 2.

Table 2: Inter-rater and intra-rater reliability for the different tests described by the Proportion of Agreement (PoA) and Cohens' Kappa.

	Inter-rater		Intra-rater	
Test	PoA	Kappa	PoA	Kappa
1	0,741	0,381	0,862	0,585
2	0,483	0,193	0,776	0,293
3	0,707	0,266	0,776	0,267
4	0,759	0,425	0,707	0,239
5	0,793	0,491	0,793	0,555
6	0,759	0,100	0,690	0,385
7	0,845	0,691	0,879	0,753
8	0,931	0,164	0,828	0,328
9	0,672	0,367	0,690	0,204
10	0,793	0,430	0,776	0,510
11	0,828	0,253	0,810	0,230
12	0,931	0,558	0,879	0,294
13	0,879	0,734	0,810	0,460

4 DISCUSSION

The purpose of this study was to investigate the inter- and intra-rater reliability of the RunningSmart testing protocol, a new screening tool to assess weak biomechanical links that could induce running injuries in novice runners.

Overall, the tool had a fair to good inter- and intra-rater reliability (Rosner, 2010). The inter-rater and intra-rater reliability for the separate clinical tests based on the kappa value was average to good (Altman, 1990). Moreover, the PoA was moderate to excellent for inter-rater reliability and good to excellent for intra-rater reliability.

Since the applied algorithm to obtain the final score remains unclear e.g. different scores on individual tests, it is assumed possible that a

different score on the subtests was obtained between two assessors although the final score was the same. This is the same limitation as reported in other screening protocols (Teyhen et al., 2012). Creators of these screening tools could provide researchers more information about the score implementation.

The majority of the afore mentioned screening protocols focus on athletes while the RunningSmart Tool focusses mainly on recreational runners or people that initiate running. Therefore the tool is designed in a practical and easy to apply way that can be used in a clinical setting.

The researchers in this study had the same experience and educational level. Moreover, they were trained as a RunningSmart Coach (two days practical education), however their practical experience as a therapist in a clinical setting was limited. The clinicians tested individually and in separate rooms. No video recordings were made. The screening battery is easy to use for familiarized professionals and requires minimal equipment.

The possible learning effect of the participants was limited as the researcher did not give feedback about the outcome.

Further research towards reliability and validity of screening protocols to prevent running injuries is mandatory. Moreover, randomized long-time follow-up trials could be conducted to estimate the incidence of running injuries in participants that initiate running as the effect of the screening protocol and proposed exercises could be evaluated.

These data indicate that the RunningSmart Screening tool can be confidently applied by trained individuals and used to assess the movement patterns of recreational start-to-runners in order to make decisions related to interventions to decline the injury risk and enhance physical activity.

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