Rugby Codes Research Group

e-Magazine

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Hume, P.A. Editor.

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RCRG website:
https://sprinz.aut.ac.nz/areas-of-expertise/interdisciplinary-research/rugby-codes

AUT SPORTS PERFORMANCE RESEARCH INSTITUTE NEW ZEALAND

AUT MILLENNIUM

Professor Patria Hume - e-Mag Editor Welcome

Welcome to issue 6 of the Rugby Codes Research Group (RCRG) e-Magazine. The aim for the RCRG e-Magazine is to communicate advances in evidence-based knowledge and its practical application to the wider support network of rugby codes. In this issue we provide updates on work by members including publication details and poster content.

The Rugby Codes Research Group (RCRG) celebrates 10 years of existance in 2019.

We look forward to your continued work to improve performance and reduce risk of injury in the rugby codes.

Dr Farah Palmer – Sport NZ Leadership Award

In New Zealand we celebrate Dr Farah Palmer being awarded the Halberg "Sport New Zealand Leadership Award".

This is the highest sports leadership award in New Zealand and well deserved for her leadership in rugby including being the first woman appointed to the NZ Rugby board. Farah is an active researcher and is perhaps best known for her role as the former captain of the NZ Black Ferns – the New Zealand Women's Rugby World Cup Champions.

Dr Clare Fraser – Project Update

Australian Rugby Player Eye Health Study

In the weeks leading up to Christmas the Save Sight Institute hosted the second clinic day for our Sydney based study investigating the eye health of Australian Rugby players. The health risks of contact sports have been a hot topic in the media recently, with numerous studies demonstrating concussion related cognitive and neuropathological changes in contact sport players, a condition referred to as Chronic Traumatic Encephalopathy (CTE). One of the features of CTE is thinning of white matter in the brain, a type of brain tissue which represents connections between neurons. Dr Clare Fraser, a neuro-ophthalmologist, and her team believe that given the connections between the brain and the eye, the changes seen in CTE may also manifest in the eye by way of retinal thinning. This thinning could therefore be detected non-invasively using Optical Coherence Tomography, a modern technique that scans structures inside the eye including the retina. If such a link is found this technology may have uses in both early detection and monitoring of CTE. In addition, the team are also looking at the rates of other eye health problems including retinal detachment, glaucoma and cataract. The clinics to date have been lively and often serve as an opportunity for players to catch up with one another. Our most recent clinic included well known former Professional Rugby League legends Mr Paul Sironen and Mr Steve Roach ('The Blocker'). The study will be running into the first quarter of 2019, with more clinics planned.

Left to right: Nina Mustafic (Orthoptist), Dr Clare Fraser (Neuro-ophthalmologist), Paul Sironen and Steve Roach (former Professional Rugby League players), Dr Julian Kelman (Masters Student)

Clare is also now collaborating with Dr Michael Buckland - neuropathologist and Dr Rowena Mobbs – neurologist. For further information contact:

Clare Fraser
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Consultant Ophthalmologist (VMO) - Sydney Eye Hospital, St Vincent's Hospital

Mark Hecimovich – Project Update

Mark Hecimovich (USA) and Doug King (NZ) are analysing data for the project "Saccades, fixation and blink counts in Sport Related Concussion: Utilizing King-Devick eye tracking in collegiate rugby".

Contact Mark for further information:
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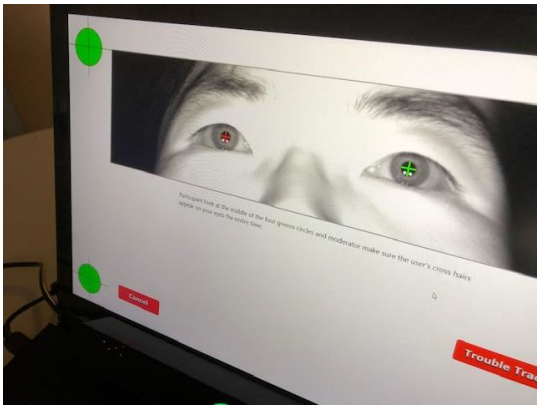

Dr Sarah Kate Millar – Project Update

Dr Sierra Keung and Dr Sarah Kate Millar (both AUT) are collaborating on the project "Exploring athlete pathways: Players, barriers and facilitators of talent development within Rugby League in New Zealand" with Dr Donna O'Connor, Professor (University of Sydney); Dr Stephen Cobley (University of Sydney), Balin Cupples, PhD candidate (University of Sydney).

Sierra graduated her PhD in December 2018: Link to thesis: http://hdl.handle.net/10292/11941

Keung, S. (2018). *Te taha hinengaro: Using talanoa to facilitate an interconnected analysis of psychosocial development shared Māori and Pasifika young men in Rugby League* (Doctoral Thesis). Auckland University of Technology, Auckland, New Zealand.

The Global Rugby Health Research Programme – Ethics tracking

The SPRINZ Code of Ethics for Members includes the statement:

- **"ensure ethical approvals are obtained from the appropriate bodies where necessary"**

The list below shows the ethics tracking for the Global Rugby Health Research Programme. Please send details to Patria.Hume@aut.ac.nz

- Hind, K., I Entwistle (2016, updated 2018). Ethics: General Health and Neurocognition in retired rugby players: the UK Rugby Health project (part 1 of UK Rugby Health).
- Hind K, Chazot P… Hume P (2018 - 2022) Ethics: General Health and Neurocognition in retired rugby players: Global Rugby Health Research Programme.
- Hind K, Chazot P.. Hume P (2018 – 2020): Ethics: Blood biomarkers of brain health in retired rugby players – ethics for analysis of serum at Durham. UK Rugby Health project.
- Hind, K., I Entwistle… Fitzgerald M, Hume P (2016, updated 2018 to include analysis of plasma at Curtin University, Australia). Ethics: Clinical assessments in retired rugby players: the UK Rugby Health project. (part 2 of UK Rugby Health project).
- Hind, K., Tsakarides, C., Swainson, M., Stavropoulos-Kalingoglou, A., Sharma, A (2017). Ethics: Functional near-infra red spectroscopy of the right and left prefrontal cortex in retired rugby players with concussion and retired non-contact athletes: the UK Rugby Health project. (sub study).
- Hume, P. A., Neary, P., Wood, M., & McGeown, J. (2018). AUTEC #18/44: Global RugbyHealth Research Programme: Integration of multimodal imaging techniques for assessment and diagnosis of concussion or mild traumatic brain injury (mTBI).
- Hume, P. A., McGeown, J., Hardaker, N., Theadom, A., Quarrie, K., Kara, S., . . . Selfe, J. (2018). AUTEC# 18/46 Assessing the incidence, management and outcomes following sport-related concussion in New Zealand. A cohort study investigating presentations to a sport-concussion service.
- Hume, P. A., McGeown, J., Hardaker, N., Theadom, A., Quarrie, K., Kara, S., . . . King, D. (2018). AUTEC# 18/374 - Investigating gender differences and the clinical utility of objective neurophysiological measures for sports-related mTBI.
- Hume, P. A., McGeown, J., Hardaker, N., Theadom, A., Quarrie, K., Kara, S., . . . King, D. (2018). AUTEC# 18/375 - Investigating gender differences and the clinical utility of objective neurophysiological measures for sports-related mTBI.
- Hume, P. A., & McGeown, J. (2018). AUTEC#18/45 Measuring physiological and neurological function during post-concussion syndrome: A case study.
- Hume, P. A., McGeown, J., & Dulson, D. (2018). AUTEC# tbd - Inter- and intra-hour salivary biomarker (BDNF) fluctuations in healthy participants.
- Hume, P. A., & King, D. (2017). AUTEC# 17/303 Use of steady-state visual evoked potentials for the identification of concussion in amateur sports-participants.
- Hume, P. A., & Iwamoto, S. (2017). AUTEC #16/229 The relationship between injury frequency, performance and body composition in rugby players.
- King, D., Hume, P. A., & Gisanne, C. (2016). AUTEC # 16/35 Impact forces associated with match participation in amateur women's netball, soccer and rugby league and the identification of sport-related concussion.
- Hume, P. A., & Lopez Jr, V. (2018 in progress). AUTEC # TBD - Injury Risk Factors in USA Rugby 7s Playing Populations.
- Hume, P. A., Theadom, A., Lewis, G., Quarrie, K., Raftery, M., Marshall, S., . . . Brown, S. (2012). AUTEC 12/252 Rugby Health: World Rugby/NZ Rugby/AUT RugbyHealth project. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand.

For details on the UK Rugby Health Research Programme please contact karen.hind@durham.ac.uk

New Technology

This is a comment on new technology provided by the eMag editor Prof Patria Hume, after receiving an email from the supplier Brenton Short. This comment is not an endorsement of the product – rather information to the RCRG members. Prof Lindy Fitgerald in Perth, Australia, is now using this technology for the analysis of Dr Karen Hinds blood samples for the collabroative UK Rugby Health Project.

There is a new technology "that would enable you to potentially diagnose and monitor recovery from TBI/concussion via the use of serum biomarkers, which would allow you to objectively measure biological outcomes of impacts observed via the X-Patch system.

GeneWorks are the Australian/New Zealand distributors for Quanterix, who have developed an ultrasensitive digital ELISA platform called the Single Molecule Array, or Simoa. This platform provides unparalleled sensitivity (sub fg/ml) in a range of biological matrices and has proved extremely popular in both concussion and neurodegenerative disease research, where this sensitivity has allowed the detection of biomarkers of a range of neurological disorders in blood thus obviating the need for CSF sampling. Quanterix offer a range of single and multi-plex kits looking at a range of biomarkers (GFAP, Tau, NF-Light, UCH-L1 etc) via analysis of serum samples.

Additionally, the Simoa platform can be used to examine microRNAs at a similar sensitivity to PCR based methods without the need for nucleic acid amplification, which could potentially allow you to increase the specificity and sensitivity of your test by analysing both nucleic acid and protein biomarkers.

Quanterix offer a semi-automated instrument, the SR-X as well as the fully automated HD-1, which would enable routine diagnostic analysis of serum samples in an automated, high throughput manner." *(email to P Hume, 15/02/2019).*

For further information contact:

Brenton Short
Scientist (Immunoassay and Cell Biology)

GeneWorks Pty Ltd | **Head Office** | 28 Dalgleish Street, Thebarton SA 5031, Australia
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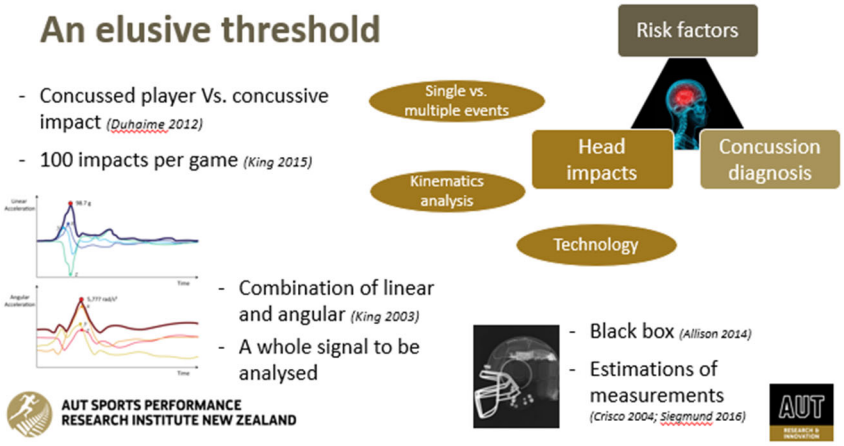
Enora Le Flao PhD candidate - Project Update

Le Flao, E. (2019 in progress). *Head impacts monitoring in rugby: Development of new methods for analysis of acceleration signals.* (PhD thesis in progress), Auckland University of Technology.

A validation study of the CSx mouthguards is on-going for my PhD in collaboration with my PhD supervisors (Prof Patria Hume, Dr Doug King) and collabortors from Strasbourg University, France (Dr Khyati Verma, Dr Nicolas Bourdet and Prof Remy Willinger) and Lincoln University, NZ (Dr Mike Hamlin, Dr Sohei Takamori). The validity and reliability of the linear and angular components of the sensors will be assessed, as well as the overall validity with respect to a Hybrid III head form. An initial paper on the linear data was submitted to the International Society of Biomechanics conference in Calgary 2019.



Publications have included a Sports Medicine literature review, a ISBS conference 4-page paper, and a one page SMNZ abstract:

- Le Flao, E., Brughelli, M., Hume, P. A., & King, D. (2018). Assessing head/neck dynamic response to head perturbation: A systematic review *Sports Medicine, 48(11)*, 2641–2658. doi:https://doi.org/10.1007/s40279-018-0984-3
- Le Flao, E., Hume, P., & King, D. (2018). Head impact monitoring: what new methodologies could do for concussion biomechanics. *Proceedings of the 36th International Conference of Biomechanics in Sports., 36*(1), 1041-1044.
- Hume, P. A., Le Flao, E., McGeown, J., King, D., Theadom, A., Kara, S., . . . Quarrie, K. (2019). An update on SPRINZ sports related traumatic brain injury research - SMNZ abstract. *New Zealand Journal of Sports Medicine*.

Two literature reviews on head impacts research are on-going:

- Le Flao, E., Hume, P. A., & King, D. (2019 under review). In vivo head impact monitoring in sport: a systematic review of decades of research. *Sports Medicine*.
- Le Flao, E., Hume, P. A., & King, D. (2019 in progress). Meta-analysis of the sensitivity and specificity of PLA and PAA for identifying sports-related concussions. *Sports Medicine*.

Professor Lindy Fitzgerald - Project Update

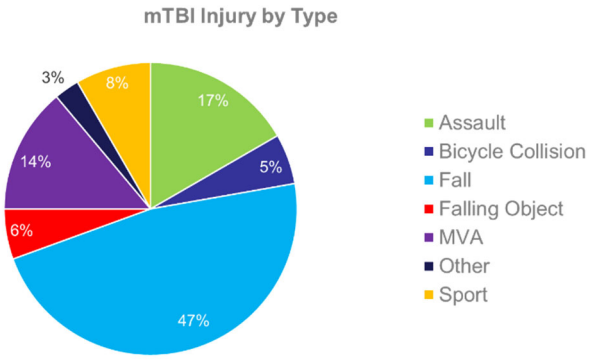
Abstract presented at the Australasian Neuroscience Society annual conference in Brisbane in December 2018. The manuscript describing the work is currently being prepared for publication. The work was also presented at the Australian College of Emergency Medicine Meeting in Perth in November 2018 and the Trauma 2018 meeting in Perth in October 2018.

PREDICTING OUTCOMES FOLLOWING MILD TRAUMATIC BRAIN INJURY

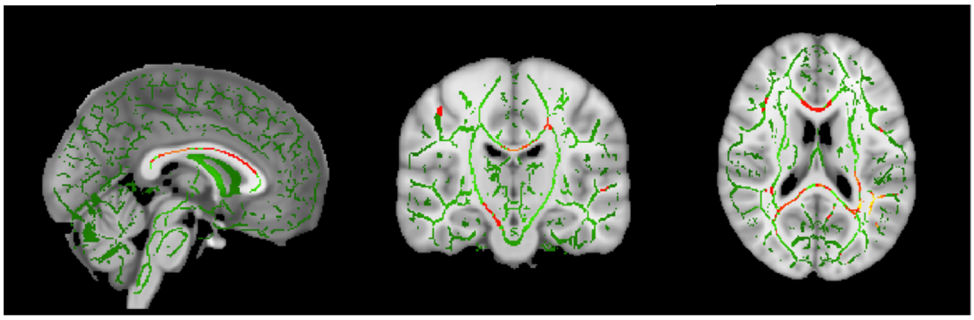
Aleksandra Gozt[1,2], Melissa Licari[3], Alison Halstrom[4], Hannah Milbourn[4], Anna Black[1,2], Glenn Arendts[5,11], Stephen Macdonald[5,9,11], Swithin Song[10], Ellen Macdonald[9,11], Michael Bynevelt[6,8], Carmela Pestell[7], Daniel Fatovich[5,9,11], Melinda Fitzgerald[1,2,4]

[1]Curtin Health Innovation Research Institute, Curtin University, [2]Perron Institute for Neurological and Translational Science, Ralph and Patricia Sarich Neuroscience Research Institute Building, Verdun St, Nedlands 6009 Western Australia, Australia; [3]Telethon Kids Institute, West Perth; [4]School of Biological Sciences, [5]Emergency Medicine, [6]School of Surgery, [7]School of Psychological Science, The University of Western Australia; [8]Neurological Intervention & Imaging Service of Western Australia; [9]Emergency Department, [10]Radiology Department, Royal Perth Hospital; [11]Centre for Clinical Research in Emergency Medicine, Harry Perkins Institute of Medical Research, Perth, Western Australia, Australia

Post-Concussion Syndrome (PCS) is a complex condition where symptoms of concussion persist beyond the timeframe that they typically resolve. However, there is currently a lack of predictive measures that can be used to direct clinical care. Here, we assessed blood-based biomarkers, MRI and neuropsychological outcomes in a cohort of concussion patients (mTBI) at the time of presentation to Royal Perth Hospital Emergency Department (T0), and related these to outcomes at 28 days (n=36), and/or age matched healthy controls. The Repeatable Battery for the Assessment of Neuropsychological Status total score was significantly lower at T0 in patients that developed PCS, than in patients that recovered normally (t (34) = 2.8215; p = 0.008). Diffusion Tensor Imaging analyses using tract based spatial statistics in a subset of patients indicated that fractional anisotropy measures in the left inferior frontal occipital fasciculus (IFOF) were significantly lower in mTBI patients than controls (t (20.587) = -2.174; p = 0.042). This area of the brain is implicated in visual-spatial processing abilities. There was a statistically significant difference in the plasma concentration of GFAP amongst the three groups (ANOVA: F (2,60) = 12.903, p < 0.001), with a significant increase with mTBI relative to control (p < 0.001). The goal is to establish a predictive model of PCS based on a suite of outcome measures that can be used to identify patients at risk of poor outcome following concussion. The work is being developed as a broader nationwide collaboration to improve lives following traumatic brain injury.



NOTE: The slides are from the talks and are presentated without detailed explanation, and without compromising copyright for later publication.



Subset of participants: N=15 mTBI (3 with PCS), N=8 controls. Tract based spatial statistics: mTBI compared to control, no significant differences. Red - areas of the brain in which mTBI patients had lower FA values than healthy, uninjured age and gender-matched controls within the mean FA skeleton (green).

Professor Mike Hamlin - Project Update

Mike has conducted a number of studies with colleagues resulting in journal publications:

T. Raj., C. Elliot., Hamlin, M.J. Impact of 12-weeks of yoga intervention on balance in university level rugby players. 8th World Congress of Biomechanics, Dublin, Ireland July 8-12, 2018; p4272.

The results of this inquiry confirm previous finds indicating that yoga may decrease postural sway and improve balance. If a decrease in postural sway correctly reflects an increase in balance in our subjects, we might expect more efficient movement patterns in our players after such a yoga intervention. Decreased postural sway may also reflect increased proprioception in the foot and ankle after the yoga intervention which may result in fewer injuries.

Hamlin, M.J., Deuchrass, R. Smith, H. Elliot, CA. Lizamore, CA. Reliability of the 1.2 km shuttle run test in young elite rugby union players. *European College of Sport Science 23rd Annual Congress*, Dublin, Ireland July 4-7, 2018; pp213.

The standardized typical error (0.37) suggests moderate congruency between the two 1.2 km shuttle tests, but the reliability found in this study on elite young rugby players (coefficient of variation was 2.1%) is typically better than that found in young active recruits completing the same test (coefficient of variation approximately 10%), or under 17 soccer players completing a Yo-Yo Intermittent Recovery Test Level 1 (coefficient of variation approximately 8%).

Impact of 12-weeks of yoga intervention on balance in university level rugby players

Tilak Raj
Dr. Catherine Elliot
Dr. Mike Hamlin

Department of Tourism, Sport and Society,
Faculty of Environment Society and Design,
Lincoln University, New Zealand.

Abstract

Impaired balance can result in increased postural sway, particularly in the horizontal plane (anterior-posterior and lateral-medial) [1]. In an attempt to reduce the risk of injury that accompanies poor balance, some strength and conditioning trainers incorporate balance and postural control training into athlete's exercise routines. However, relatively few balance interventions involve the use of yoga. Therefore, the purpose of this study was to evaluate the impact of a 12 week structured yoga intervention (which included balance training) on single and double foot balance (measured as postural sway) of male rugby union players.

Method

Twenty-nine male rugby union players, (19 + 1.3 years, mean ±SD) were assigned randomly to 2 groups; an experimental group (EG n=15), who practiced yoga for one hour, two times a week for 12 weeks in addition to their normal rugby training, and a control group (CG n=14), who continued with their normal rugby training routine without any yoga intervention. Balance data (anterior-posterior (Fx) lateral- medial (Fy), and vertical ground reaction force (Fz) as well as anterior-posterior (Copx) and lateral-medial (Copy) centre of pressure) was collected pre-season, mid-season, and at the end of the season on a force platform (Bertec Corp, Columbus, OH). All measures were taken during a 30s period with the players standing on their right and left leg with eyes open, as well as standing on both legs with eyes open and eyes closed.

Results

Overall there was very little change in postural sway measures (measured as the mean SD over the 30-s period) between groups from baseline to mid-season (6-weeks Fx, Fy, Fz, Copx, and Copy P>0.05 for one leg and two-legged stance with eyes open and closed). By end of the rugby season (12 weeks), compared to the control group, the experimental group had significantly reduced postural sway in number of balance markers (two-leg eyes open Fx = -72%, two-leg eyes open Fy = -124%, two-leg eyes open Fz = -253%, two-leg eyes open Copx = -63%, p<0.001 for two-legged eyes open and two-leg eyes close Fz = -389%, p<0.001 for two-legged eyes closed).

Conclusion

Results suggest that short term (6 weeks) yoga practice had little effect on measures of balance. However, yoga may help reduce postural sway and thereby improve balance, when practiced over a longer period (e.g. 12 weeks).

Introduction

Rugby, a field-based contact sport and one of the most commonly played sports in New Zealand requires players to be physically strong and able to engage in frequent bouts of high intensity exercise. Along with other components of fitness, balance plays a major role in a rugby player's running, tackling, passing, and scrumming performance.

Impaired balance can result in increased postural sway, particularly in the anterior-posterior and lateral-medial planes which may result in undesired movement patterns possibly affecting player's performance. Yoga, an exercise regime that involves various static and dynamic stretching positions, breathing techniques, and relaxation has been shown to improve balance, yet relatively few balance interventions involve the use of yoga. The purpose of this study was to evaluate the impact of a 12-week structured yoga intervention (which included balance training) on single and double foot balance (measured as postural sway) in male rugby union players.

Method

Data was collected at the same time of the day at Lincoln University using a force plate (Bertec Corp, Columbus, OH) on 3 occasions (baseline, 6 weeks and 12 weeks). Data from the force plate (sampled at 100Hz) included; Anterior-Posterior Force (Fx), Lateral–Medial Force (Fy), Vertical Ground Reaction Force (Fz), Centre of Pressure Anterior-Posterior Force (Copx), and Centre of Pressure Lateral-Medial Force (Copy) which was exported to Microsoft Excel. The raw data was then normalised to subjects body mass [2] and the standard deviation of each 30-second signal was used as an indicator of postural sway variability. The data presented is the average of all subjects standard deviation's for each task within each group.

References

1. Bressel, E., et al. Comparison of Static and Dynamic Balance in Female Collegiate Soccer, Basketball, and Gymnastics Athletes. Journal of Athletic Training, 2007; 42(1): p. 42-46.
2. Oneil, A., The vertical ground reaction force for analysis of balance? Gait & Posture, 2000; 12(1): p. 7-13.
3. Youkhana, S., et al., Yoga-based exercise improves balance and mobility in people aged 60 and over: a systematic review and meta-analysis. Age and Ageing, 2016; 45(1): p. 21-29.
4. Ikai, S., et al., Effects of yoga therapy on postural stability in patients with schizophrenia spectrum disorders: A single-blind randomized controlled trial. Journal of Psychiatric Research, 2013; 47(11): p. 1744-1750.
5. Rogers, M.E., J.E. Fernandez, and R.M. Bohlken, Training to reduce postural sway and increase functional reach in the elderly. Journal of Occupational Rehabilitation, 2001; 11(4): p. 291-298.

Results

We found no significant differences in any variables between groups 6 weeks into the intervention (data not presented). Changes in balance from baseline to 12 weeks for the two groups are presented in Tables 1-4.

Table 1

Postural sway changes calculated as differences in the standard deviation of a 30-second balance task between the yoga and control group for:

	RIGHT LEG ONLY - EYES OPEN				
	Control (CG)		Experimental (EG)		
Balance markers	Baseline	12-week Post	Baseline	12-week Post	Difference* (%)
Fx	0.04 ± 0.02	0.04 ± 0.01	0.03 ± 0.02	0.02 ± 0.01	-21%
Fy	0.03 ± 0.01	0.04 ± 0.01	0.03 ± 0.01	0.03 ± 0.03	-38%*
Fz	0.05 ± 0.03	0.08 ± 0.02	0.05 ± 0.03	0.05 ± 0.04	-73%
Copx	0.00 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	3%
Copy	0.00 ± 0.01	0.00 ± 0.00	0.00 ± 0.01	0.00 ± 0.00	1%

Notes for Table 1 - 4

Data are mean ± SD; *Significant difference between the baseline and the 12-week post-test; Fx; SD of the force signal in the anterior-posterior direction, Fy; SD of the force signal in the lateral-medial direction. Fz; SD of the force signal applied in the vertical direction, Copx; SD of the centre of pressure force signal in anterior-posterior direction, Copy; SD of the centre of pressure force signal in lateral-medial direction.

Table 2

	LEFT LEG ONLY - EYES OPEN				
	Control (CG)		Experimental (EG)		
Balance markers	Baseline	12-week Post	Baseline	12-week Post	Difference* (%)
Fx	0.04 ± 0.02	0.05 ± 0.02	0.03 ± 0.02	0.03 ± 0.01	-39%
Fy	0.03 ± 0.01	0.06 ± 0.02	0.03 ± 0.01	0.03 ± 0.01	-82%*
Fz	0.05 ± 0.03	0.11 ± 0.05	0.05 ± 0.03	0.05 ± 0.02	-109%
Copx	0.02 ± 0.05	0.00 ± 0.00	0.01 ± 0.02	0.00 ± 0.00	1%
Copy	0.01 ± 0.03	0.00 ± 0.00	0.01 ± 0.02	0.00 ± 0.00	0%

Table 3

	BOTH LEGS - EYES CLOSED				
	Control		Experimental		
Balance markers	Baseline	12-week Post	Baseline	12-week Post	Difference* (%)
Fx	0.03 ± 0.03	0.02 ± 0.00	0.02 ± 0.01	0.01 ± 0.00	-53%
Fy	0.01 ± 0.00	0.02 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	-173%
Fz	0.01 ± 0.00	0.05 ± 0.01	0.01 ± 0.00	0.01 ± 0.00	-389%*
Copx	0.01 ± 0.02	0.00 ± 0.00	0.00 ± 0.01	0.00 ± 0.00	1%
Copy	0.00 ± 0.01	0.00 ± 0.00	0.00 ± 0.01	0.00 ± 0.00	-1%

Table 4

	BOTH LEGS - EYES OPEN				
	Control		Experimental		
Balance markers	Baseline	12-week Post	Baseline	12-week Post	Difference* (%)
Fx	0.01 ± 0.01	0.03 ± 0.01	0.01 ± 0.01	0.02 ± 0.01	-72%
Fy	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	-124%*
Fz	0.01 ± 0.01	0.04 ± 0.01	0.01 ± 0.00	0.01 ± 0.00	-253%*
Copx	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	-63%
Copy	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	-78%

Conclusion

The results of this study confirm previous findings indicating yoga may decrease postural sway and improve balance [3, 4]. If a decrease in postural sway correctly reflects an increase in balance in our subjects, we might expect more efficient movement patterns in our players after such a yoga intervention. Decreased sway may also reflect increased proprioception in the foot and ankle after the yoga intervention which may result in fewer injuries[5].

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Reliability of the 1.2 km shuttle run test in young elite rugby union players

Michael J. Hamlin[1], Richard Deuchrass[2], Hoani Smith[2], Catherine A. Elliot[1], Catherine A. Lizamore[1].

[1] Department of Tourism, Sport and Society, Lincoln University, Christchurch, New Zealand.
[2] Lincoln University Recreation Centre, Lincoln University, Christchurch, New Zealand.

Abstract

To be useful, fitness tests need to have adequate reliability (i.e. reproducible results), so that important changes in athlete's performance can be identified. The aim of this study was to investigate the reliability of the 1.2 shuttle run test (1.2SRT), a novel field test also known as the Bronco test, on young elite rugby players. On two occasions, separated by 2-3 weeks during the pre-season, 40 male elite rugby players (21 forwards, 19 backs, age 19.0 ± 1.1 yr, mean ± SD), completed the 1.2SRT on a grass rugby pitch in their usual playing footwear, under similar environmental conditions. To complete the 1.2SRT, players completed maximal shuttle runs to and from a start line to 20, 40 and 60-m marks, 5 times without a break. Players were scored on the time taken to complete the shuttle runs. Prior to the study, all players were familiarized with the 1.2SRT and to ensure consistency, players completed a standardized warm-up before the test. To minimize confounding variables, players were asked to refrain from heavy exercise and consumption of alcohol for 24 hours prior to all testing, and to avoid heavy meals or caffeinated beverages for 2 hours prior to testing. Overall performance increased by 1.0% between tests (3.96 ± 0.23 m/s to 4.00 ± 0.24 m/s, mean ± SD), which corresponded to a higher post-test rate of perceived exertion (17.9 to 18.2 on the Borg 6-20 scale). For all players combined, the standardized typical error of the average speed between tests was 0.37, 0.31-0.45 (mean, 90% CL) which corresponds to a coefficient of variation of 2.1% (1.8-2.6%). The typical error was similar between forwards (0.39) and backs (0.54). We conclude that the 1.2SRT demonstrated moderate between-test reliability when conducted under similar environmental conditions and suspect that increased fitness levels in individuals between tests may have contributed to the increased variability and lower reliability than expected.

Introduction

Reliability is important in any fitness testing because good reliability enables practitioners to identify small but practically important changes in individual subjects while allowing researchers to quantify changes in controlled trials with reasonable sized subject samples.

Methods

Forty players from the Christchurch region in New Zealand participated in two 1.2RST's conducted over 3 weeks in March 2017. Ethical approval for this research was obtained from the local University Human Ethics Committee (reference 2017-06). The 1.2SRT consists of a continuous, straight-line, maximal, there and back again shuttle run (See Figure 1), repeated 5 times. Average speed calculated as distance covered during the test divided by the time taken to complete the test was used in the analysis. The standardized typical error (Cohen's *d*) was used to determine the magnitude of error, which needs to be doubled (4), and interpreted using 0.2, 0.6, 1.2, 2.0 and 4.0 to indicate small, moderate, large, very large and extremely large effects respectively (3).

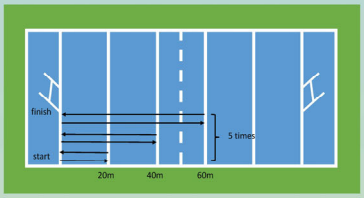

Figure 1. The 1.2 km Shuttle Run Test shown on a rugby field.

Results

The test re-test 1.2SRT performances of the rugby players are shown in Figure 2 and Table 1.

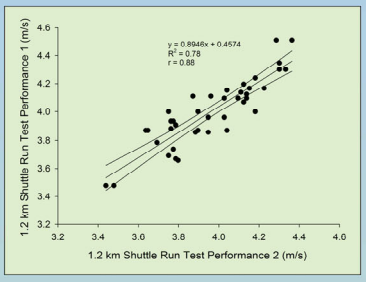

Figure 2. Reliability of the average speed during the 1.2 Shuttle Run Test completed 2-3 weeks apart.

Table 1. Performance measurements in the two 1.2 Shuttle Run Tests along with the standardised typical error between test performances and the magnitude based inference.

	TEST 1	TEST 2
Body weight (kg)	94.8 ± 10.4	95.0 ± 10.0
Average performance speed (m/s)	3.96 ± 0.23	4.00 ± 0.24
Rating of Perceived Exertion	17.9 ± 1.1	18.2 ± 0.9
Standardised typical error for the average speed		
All Players	0.37 (0.31-0.45) moderate*	
Forwards	0.39 (0.31-0.53) moderate*	
Backs	0.54 (0.43-0.75) moderate*	
Typical error as a coefficient of variation (CV) for the average speed.		
All Players	2.1% (1.8-2.6%)	
Forwards	2.0% (1.6-2.8%)	
Backs	2.1% (1.7-2.9%)	

Data is mean ± SD for the performance measures. *The standardized typical error along with the 90% CL(Cohen's *d*) needs to be doubled (6), and interpreted using 0.2, 0.6, 1.2, 2.0 and 4.0 thresholds to indicate small, moderate, large, very large and extremely large effects respectively (5). The typical error is also given as a coefficient of variation (CV) for comparison with other tests.

Discussion

The standardised typical error suggests moderate congruency between the two tests, but the reliability found in this study on elite young rugby players is typically better than that found in young active recruits completing the same test (CV ~ 10%) (1), or under 17 soccer players completing a Yo-Yo intermittent recovery test (CV ~ 8%) (2).

Acknowledgements

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References

1. Brew, DJ and Kelly, VG. The reliability of the 1.2 km shuttle run test for intermittent sport athletes. J Aust Strength Cond 22: 127-131, 2014.
2. Deprez, D, Coutts, AJ, Lenoir, M, Fransen, J, Pion, J, Philippaerts, R, and Vaeyens, R. Reliability and validity of the Yo-Yo intermittent recovery test level 1 in young soccer players. J Sports Sci 32: 903-910, 2014.
3. Hopkins, WG. Measure of reliability in sports medicine and science. Sports Med 30: 1-15, 2000.
4. Hopkins, WG. Spreadsheets for analysis of validity and reliability. Sportscience 19: 36-42, 2015.

Other RCRG member brief updates

Professor John Cronin is starting a wearable resistance study with the University of Pretoria in South Africa and Helen Blayne.

Professor Patrick Neary has successfully completed the collection of physiological data on 60 participants (n=50, mTBI; n=10 controls) using the "Neary Protocol" at the University of Victoria in Victoria BC (Drs Patrick Neary, Steve Martin, Catherine Gaul and Lynneth Stuart-Hill). This was funded by the CASEM, the Canadian Academy of Sport and Exercise Medicine (PI, Dr Steve Martin) ($15,000). Patrick's graduate students are currently crunching the data for publication.

Do you want to be part of the Global Rugby Health Research Programme? If so contact one of the country PI's. Please remember to fill in the membe profile form at: https://sprinz.aut.ac.nz/areas-of-expertise/rugby-codes/member-profiles. The example profile link is at the bottom of the web page.

Lead PIs: Patria, Doug, Karen

Alice, Gwyn, Ken, Denise, Scott, Rosamund, Matt, Liz

Ian, Michelle, Richard, Jenny

Antonios, Madeleine, Nigel

Patrick, Steve, Kathy, Lynneth **James,** Julian, Emily

Clare, Alan, Jarrod, Gary, Melinda, Jacqueline, Cloe

Max, Lyle, John, Scott, Steve

Professor Melinda Fitzgerald
BSc (Hons), PhD

Research specialisation: **Neurotrauma: understanding pathology, testing therapies**

Experience: Recently appointed Professor of Neurotrauma, jointly with Curtin University and the Perron Institute, located at the new Sarich Neuroscience Research Institute in Western Australia. Prof Fitzgerald has 14 years' post-doctoral experience (note parental career disruption 1998-2005) and is an independent researcher leading a team of 12 researchers and post-graduate students. Australian representative for the Asia Pacific Regional Committee for IBRO, serves on the international scientific committees for BIOMATSEN2016 and ICNT2016. Currently Held Grants/Projects total $2 million; she is CIA for all of these; total funding awarded for her career is $6.5 million, $3.9 million as CIA. Currently holds an NMHRC Career Development Fellowship, a CIA Project Grant and has previously held two NHMRC Project grants as CIA. A patent entitled 'Multifunctional Nanoparticles' reached international PCT stage and was developed by a biotechnology company. Chairperson and Convener of the annual Symposium of Western Australian Neuroscience (SWAN), and the UWA neuroscience seminar series. Member of the UWA Faculty of Science Planning Task Force addressing Grantsmanship, Mentoring and Expectations, and coordinates dissemination of collated information regarding all seminars in science and health in Perth. Reviews for numerous scientific journals including EJN, IOVS, Neurochem. Int., international funding bodies including fight for Sight UK, MS Australia and the Alzheimer's Australia Dementia Research Foundation and serves on NHMRC and MS Australia Grant Review Panels. Instituted a UWA Faculty of Science gender equity group and coordinates the UWA Faculty of Science mentoring program for PhD students and early career researchers, which extends across Institutional boundaries. Member of the Perkins Institute EMCR Mentoring Committee and regularly speaks at events regarding gender equity in science.

Research overview: Prof Fitzgerald's research is focused around understanding and preventing the loss of function that occurs following neurotrauma. She uses innovative analytical techniques to demonstrate changes to key biochemical, cellular and structural components of nerves following injury and is assessing treatment strategies including nanotechnologies and combinatorial pharmacotherapeutics. Her drive to translate her research findings to the clinic is evidenced by her current collaborative clinical trial assessing biomarkers and MRI for prediction of post-concussion syndrome.

Postgraduate supervision: In the past 5 years A/Prof Fitzgerald has supervised 20 Honours students or equivalent, 10 PhD students (5 completions), 6 post-doctoral researchers and gives regular guest lectures.

Research publications: In her 14 post-doctoral years A/Prof Fitzgerald has published 66 papers. Handling Editor for the *Journal of Neurochemistry*, an Editorial Board Member for *Neural Regeneration Research*, *Frontiers Journals* and an Associate editor for *PeerJ*. Example publications:

Halstrom, A., MacDonald, E., Neil, C., Arendts, G., Fatovich, D. and Fitzgerald, M. (2017) Elevation of Oxidative Stress Indicators in Plasma Following Traumatic Brain Injury. *J Clin Neurosci*. 35: 104.

Lozić, I., Hartz, R.V, Bartlett, C.A., Shaw, J.A., Archer, M, Naidu, P.S.R., Smith, N.M., Dunlop, S.A., Swaminathan Iyer, K., Kilburn, M.R. and Fitzgerald, M. Enabling Dual Targeting of Polymeric Nanoparticles to Macrophages and Astrocytes for Treatment of Neurotrauma. (2016) *Biomaterials* 75: 58.

O'Hare Doig, R.L., Bartlett, C.A., Maghzal, G.J., Lam, M., Archer, M., Stocker, R., Fitzgerald, M. Reactive species and oxidative stress in optic nerve vulnerable to secondary degeneration (2014) *Exp Neurol* 261: 136.

Savigni, D.L., O'Hare Doig, R.L.*, Szymanski, C.R., Bartlett, C.A., Lozić, I., Smith, N.M., Fitzgerald, M. (2013) Three Ca2+ channel inhibitors in combination reduce chronic secondary degeneration following neurotrauma *Neuropharmacology*, 75: 380.

Payne S.C, Bartlett, C.A, Harvey, A.R, Dunlop, S.A, and Fitzgerald, M. (2012) Myelin sheath decompaction, axon swelling and functional loss during chronic secondary degeneration in rat optic nerve *IOVS* 138(5):865.

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Dr James Craig Brown

PhD, Exercise Science. MPH, Health Economics

Dr James Craig Brown

Institute of Sport and Exercise Medicine and Stellenbosch University
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Research specialisation: **Injury prevention, intervention evaluation, injury epidemiology.**

Experience: James Brown did his PhD jointly at the University of Cape Town (UCT) and Vrije University Medical Centre, Amsterdam. His PhD evaluated SA Rugby's nationwide injury prevention programme, *BokSmart*, which was developed based on *RugbySmart*. James completed a 2.5 year Postdoctoral position at UCT, evaluating the BokSmart programme and is currently on a 2 year Postdoctoral position at the Institute of Sport and Exercise Medicine and Stellenbosch University, focusing on concussion (https://www.isemsun.com).

Research overview: James' research (PhD and post-PhD) has mainly focussed on the evaluation of SA Rugby's nationwide injury prevention programme (*BokSmart)*, which has involved monitoring and evaluation and epidemiology research. In addition, James has done a bit of qualitative research, using focus groups to gather information on coach and referee perceptions of *BokSmart*.

Postgraduate supervision: James has supervised 8 students to completion – 1 PhD, 1 Masters, 2 MPhil and 4 Honours. He is currently supervising 1 PhD and 2 Masters students.

Research publications and presentations: Example publications:

- Marelise Badenhorst, Mike Lambert Willem van Mechelen, Evert Verhagen, James Brown. 'In a blink of an eye your life can change': experiences of players sustaining a rugby-related acute spinal cord injury. *Injury Prevention*. Online first 5 July 2018.
- Marelise Badenhorst, James Brown, Mike Lambert Willem van Mechelen, Evert Verhagen. Quality of life among individuals with rugby-related spinal cord injuries in South Africa: a descriptive cross-sectional study. *BMJ Open*. Online first 30 June 2018.
- N Sewry, E Verhagen, M Lambert, W Van Mechelen, C Readhead, W Viljoen, J Brown. Seasonal time-loss match injury rates and burden in South African under-16 rugby teams. *Journal of Science and Medicine in Sport*. Online first 19 June 2018.
- N Sewry, E Verhagen, M Lambert, W Van Mechelen, J Marsh, C Readhead, W Viljoen, J Brown. Trends in time-loss injuries during the 2011-2016 South African Rugby Youth Weeks. *Scandinavian Journal of Medicine & Science in Sport*. Online first 10 April 2018.
- JC Brown, S Boucher, M Lambert, W Viljoen, C Readhead, S Hendricks, WJ Kraak. Non-sanctioning of illegal tackles in South African youth community rugby. *Journal of Science and Medicine in Sport.* Online first October 2017.
- Ross Tucker, Martin Raftery, Simon Kemp, Brown, J., Gordon Fuller, Bevin Hester, Matthew Cross, Kenneth Quarrie. Risk factors for head injury events in professional rugby union: a video analysis of 464 head injury events to inform proposed injury prevention strategies. *British Journal of Sports Medicine*, Online June 2017.
- James Brown, Mike Lambert, Gino Kerkhoffs, Vincent Gouttebarge. Forced retirement from Professional Rugby Union is Associated with Symptoms of Distress. *International Journal of Sports Medicine*. Online July 2017.
- Sharief Hendricks, Tiffany Van Niekerk, Drew Wade Sin, Mike Lambert, Steve Den Hollander, James Brown, Willie Maree, Paul Treu, Kevin Till, Ben Jones. Technical determinants of the tackle and ruck performance in International rugby union. *Journal of Sports Sciences*. Online 8 May 2017.
- Marelise Badenhorst, Evert Verhagen, Willem van Mechelen, Wayne Viljoen, Clint Readhead, Gail Baerecke, James Brown. A comparison of catastrophic injury incidence rates by Provincial Rugby Union in South Africa. *Journal of Science and Medicine in Sport*. Online first 24 January 2017. DOI: 10.1016/j.jsams.2017.01.232.
- Nicola Sewry, Evert Verhagen, Mike Lambert, Willem van Mechelen, James Brown. Evaluation of the Effectiveness and Implementation of the BokSmart Safe Six Injury Prevention Programme: a study protocol. *Injury Prevention*. Online first 28 February 2017. DOI: 10.1007/s40279-017-0704-4.