



College of Osteopathic Medicine

Using ClearEdge™ to Assess The Effects of Subconcussive Events on Neurocognition and Balance

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TAP TO GO BACK TO KIOSK MENU



Hypothesis

Mild traumatic brain injury (mTBI) or concussions are an increasingly high-profile public health issue¹. Men's lacrosse is a collision sport that has been historically underrepresented in concussion research even though it has almost as great of a concussion risk as football². Concussions tend to be difficult to diagnose and manage due to high heterogeneity in presentation³ and lack of a universal diagnostic tool⁴.

Our study examined the effects of repetitive subconcussive impacts on the neurocognitive function of men's collegiate lacrosse players. We hypothesized that athletes who received more impacts throughout the season would have decreased neurocognitive function at postseason compared to preseason, as shown by ClearEdge™.

Methods

- ❖ 17 NCAA Division II collegiate men's lacrosse players were enrolled prior to their 2019 season.
- ❖ Athletes wore Athlete IntelligenceCue™ Sport accelerometers in helmets to measure impacts.
- ❖ ClearEdge™ testing assessed athletes' concussion symptoms, cognitive ability and balance at preseason (baseline), midseason and postseason.
 - Neurocognitive function was tested using ClearEdgeDANA™: simple reaction time (SRT), procedural reaction time (PRT), Go-No-Go (GNG) and simple reaction time part two (SRT2).
 - Balance and stability were tested using ClearEdgeMotion™ using the Edge™ Sensor, which measures subtle changes in balance.
 - Performance on all tests was automatically recorded in the ClearEdge portal for later analysis.



Data Analysis

Change over the pre-, mid-, and postseason in each of ClearEdge test outcomes was compared using the repeated measures analysis of variance followed by the pairwise comparisons with the preseason as a reference. For all the statistical tests, significance was evaluated with $\alpha=0.05$.

Results

- ❖ Decrease in neurocognitive function, balance and stability over the course of the season.
- ❖ Procedural Reaction Time (PRT) decreased significantly from preseason to postseason (p-value=0.006).
- ❖ EOSM (Simple Balance) decreased significantly across our three testing periods (p-value=0.039).
- ❖ Composite aggregate stability measurement (ASM), a metric comparing performance on varying balance challenges.
- ❖ ASM scores decreased significantly from preseason to postseason (p-value = 0.05).

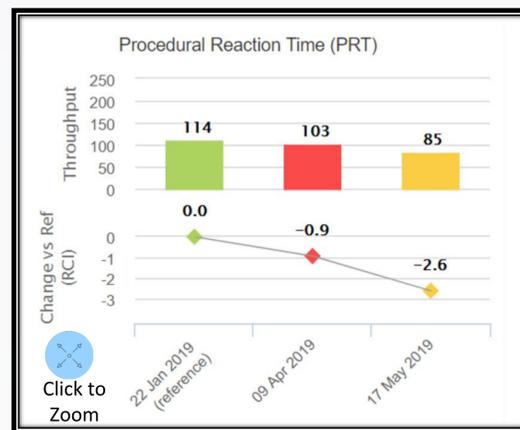
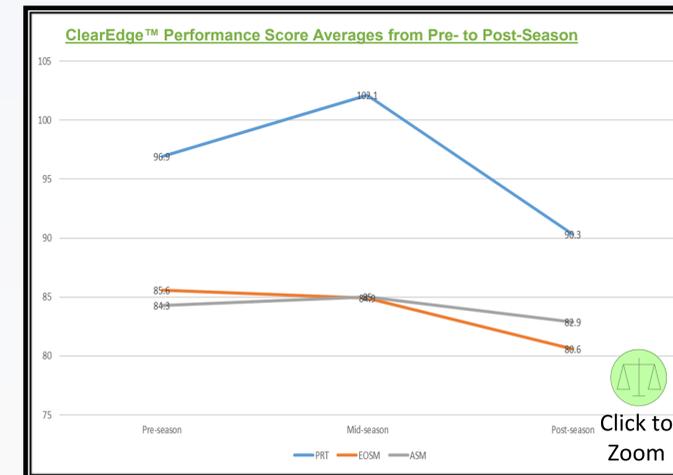


Figure 1: Procedural Reaction Time performance scores of one collegiate athlete across the course of the 2019 Men's Lacrosse Season

Conclusions

- ❖ ClearEdge™ performance scores show a statistically significant decline in neurocognitive function and balance over the course of the season.
- ❖ Significant declines were noted in PRT, ASM, and EOSM across our three testing periods.
- ❖ Limitations in the study prevent correlation of cognitive decline to the number of impacts sustained by each athlete possibly due to athlete compliance issues.
 - Athletes wore two different model helmets and experienced difficulty transferring and charging Cue™ Sport accelerometers.
- ❖ Further investigation and experimental design is required to better understand these findings and further assess a link between the number of subconcussive impacts and a decline in balance and neurocognitive function.



	Preseason	Midseason	Postseason	P-value
PRT	96.9	102.1	90.3	0.006
EOSM	85.6	84.9	80.6	0.039
ASM	84.3	85.0	82.9	0.05

Figure 2: Graph highlighting ClearEdge™ performance score averages that showed a significant decline from pre- to post-season

Significance

- ❖ Sports-related mTBI can be detrimental for collegiate athletes who are still developing regions of their brains⁵.
- ❖ By having a better understanding of injury patterns and symptomatology caused by head trauma in men's collegiate athletics, physicians and medical personnel can detect head injuries earlier and more accurately.
- ❖ The sequelae of mTBI extend beyond performance on the field; function in school, work, social and emotional relationships can also be compromised¹.
- ❖ Helping physicians understand and identify the complexity of concussion symptoms and their toll on an athletes' physical, social and emotional well-being will allow them to take a more holistic approach during treatments and guide osteopathic treatment models.

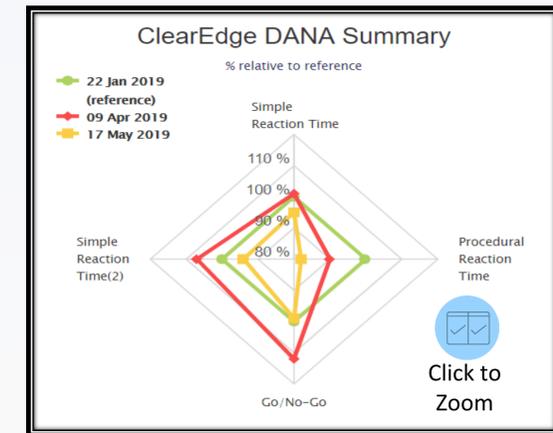


Figure 3: ClearEdge™ DANA summary from one collegiate athlete highlighting the significant change in Procedural Reaction Time over the course of the 2019 Men's Lacrosse season

References

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5. Miller DJ, et al. Prolonged myelination in human neocortical evolution. *Proc Natl Acad Sci U S A.* 2012;109(41):16480-16485.
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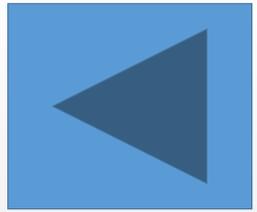
ClearEdge DANA
for Cognitive Assessment



CLEAR EDGE®



ClearEdge Motion
for Balance



Name	Task	Purpose	Preview
Simple Reaction Time (SRT)	Recognize the presence of the target and tap the target	Measure of pure reaction time	
Procedural Reaction Time (PRT)	Recognize 1 of 4 numbers and tap the appropriate button	Measure of accuracy, reaction time and impulsivity. Targets simple executive functioning with easy decision-making capabilities	
Go/ No-Go (GNG)	Recognize a green or gray alien and only "Blast" to the gray	Measure of sustained attention and impulsivity	
Simple Reaction Time 2 (SRT2)	Recognize the presence of the target and tap the target	Measure of pure reaction time. Repeated after a battery of cognitive assessments to assess for cognitive fatigue	

There are a series of 8 balance tests included in ClearEdge Motion. The proctor/HCP is required to read quoted instruction word for word to the patient and to monitor the patient's stance throughout the assessment. If the patient is unstable a test may be skipped by selecting "Skip Test"

The image displays eight individual test screens for the ClearEdge Motion Balance Tests. Each screen includes the following elements:

- Header:** CLEAR EDGE logo and "ClearEdge® Motion Balance Tests" with "SKIP TEST" and "QUIT TESTING" buttons.
- Stance:** A diagram of a person standing on a platform, labeled with the test name (e.g., "SIDE-BY-SIDE STANCE, EYES OPEN").
- Instructions:** A paragraph of instructions for the test, such as "For this test, you will stand as still as possible for 30 seconds on a firm surface, with your feet together, hands on your hips, with your eyes open."
- Buttons:** "BACK" and "START" buttons.
- Status:** A "Sensor connected" indicator at the bottom.

Proctor/HCP should be spotting the patient during the more difficult tests.

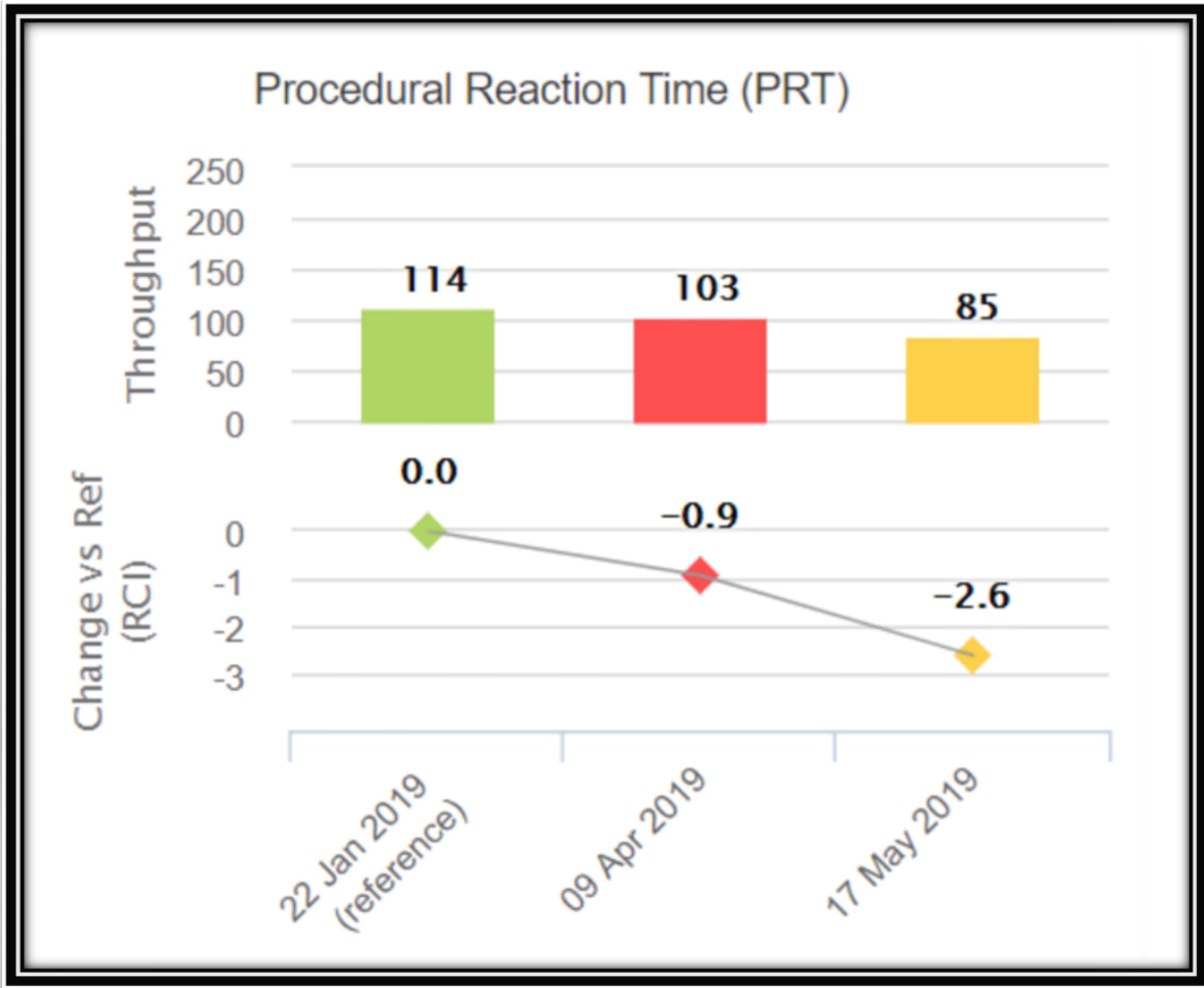


Figure 1:
Procedural Reaction
Time performance
scores of one
collegiate athlete
across the course of
the 2019 Men's
Lacrosse Season

ClearEdge DANA Summary

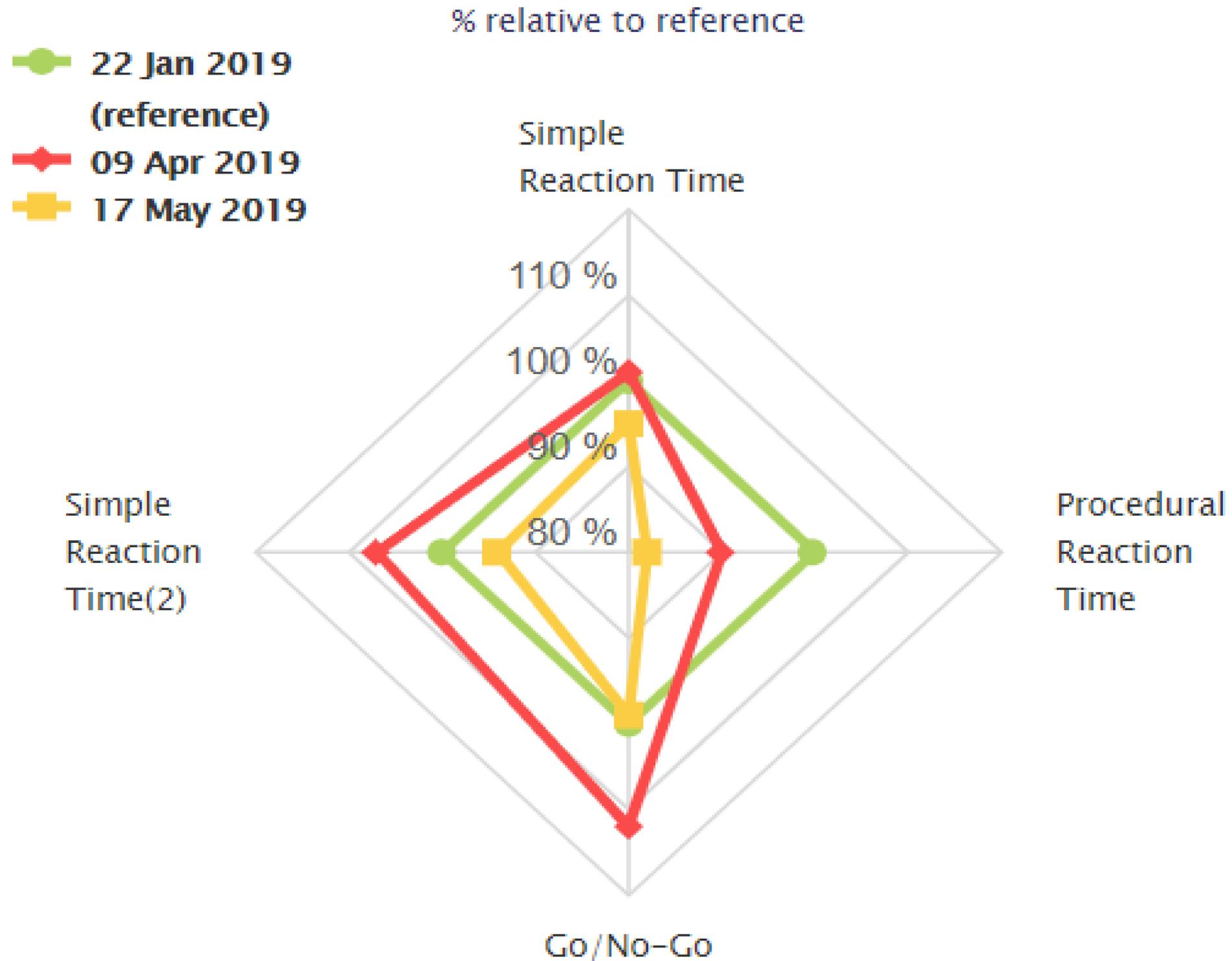
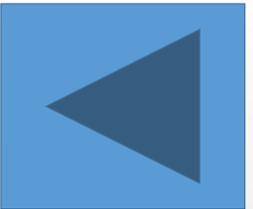
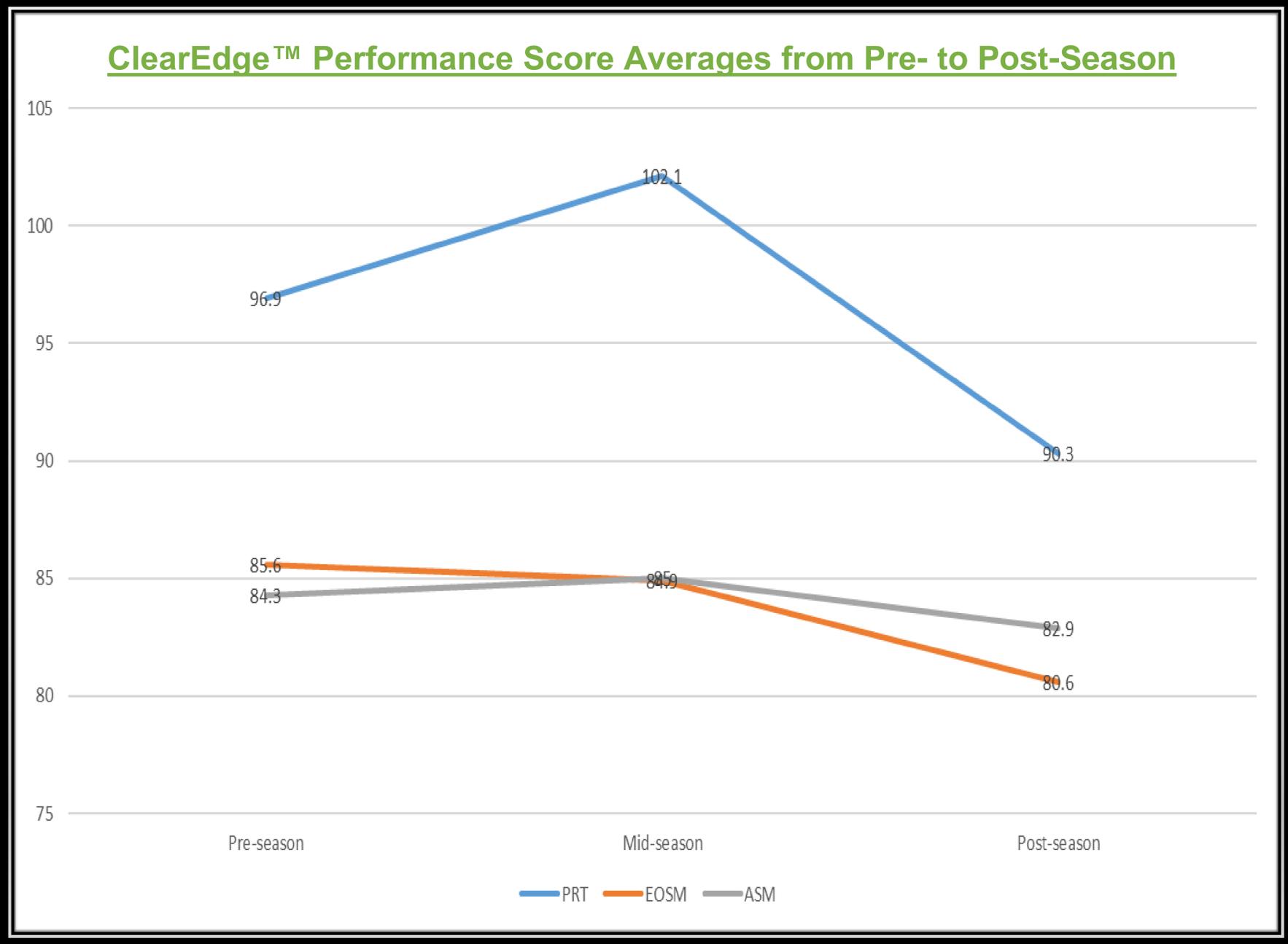


Figure 3: ClearEdge™ DANA summary from one collegiate athlete highlighting the significant change in Procedural Reaction Time over the course of the 2019 Men's



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Figure 2:
Graph highlighting ClearEdge™ performance score averages that showed a significant decline from pre- to post-season