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## Introduction

Sports related concussions among high school athletes are increasing, with mild traumatic brain injury becoming one of the leading reasons for childhood hospital admissions. Approximately 10% of young athletes who receive a concussion will experience protracted recovery of symptoms. Emerging therapies in the care and rehabilitation of post-concussive syndrome (PCS) include vestibular, oculomotor and prescriptive physical therapy; however, to date, there is little evidence to support any therapeutic intervention that provides rapid recovery of chronic PCS.

The purpose of this prospective case report of a seventeen-year-old post-concussive athlete receiving chiropractic functional neurology care was to document changes in clinically based outcome assessments along with brain activity and cognitive changes assessed through qEEG and computerized cognitive testing.



## Clinical Presentation:

A 17-year-old male presented to the NeuroLife Institute for PCS subsequent to a concussion 6-months prior. Previous care provided by a neurologist & vestibular therapist included two negative CT scans, rest, balance therapy and Adderall (not tolerated by patient). Chiropractic care was also provided by the participant's father.

Presenting symptoms included:

- Blurred vision
- Lack of coordination
- Drowsiness
- Headaches
- Cognitive symptoms, including: lack of focus & concentration, personality changes, confusion, anxiety, irritability, memory issues and difficulty in school.

## Clinical Care:

The participant was treated for five consecutive days, 2-3 sessions per day. Care included: chiropractic care, postural correction (Denneroll orthotic & extension exercises), movement exercises, motor challenges, Interactive metronome, Oculomotor exercises, electrical stimulation with gaze stabilization & GyroStim rotations.

Intervention	Day 1	Day 2	Day 3	Day 4	Day 5
Adjustment	LO	LO	LO	LC1	LO
	LC1	LC1	LC1	RC7	LC1
	RC6	RC7	RC7	RT5	RC7
	RC7	RT4	RT4		RT4
	RT3				
	RT4				
	RT5				

## Results:

Exam	Initial	Follow up (1 week)	Follow up (6 week)
Reflex	1+ R and 2+ on L	2+ bilateral	2+ bilateral
Palate	Left palatal paresis	No post check	No post check
BP	BP 120/78 R and 120/76 L	142/82 R 138/78 L	130/76 R only
Finger taps Halstead's	Hesitation and freezes on right Finger crease freezes on left	Equal bilateral w/o hesitations	Fine on right, inconsistent (hesitations) on left
March test	Lost coordination w/eyes closed, no sway	Normal	Normal
Mann's test	Felt like he was falling to right and arching to left	One fall to R, feels he is falling to R	No falls with no reported falling sensation
Posture	head tilt & L rot	R head tilt, slight	R head tilt, slight
Letters on hand	5/5 L & 4/5 R	5/5 bilateral	5/5 bilateral
Pulse ox	99	98	None
HR	83 bpm	77	None

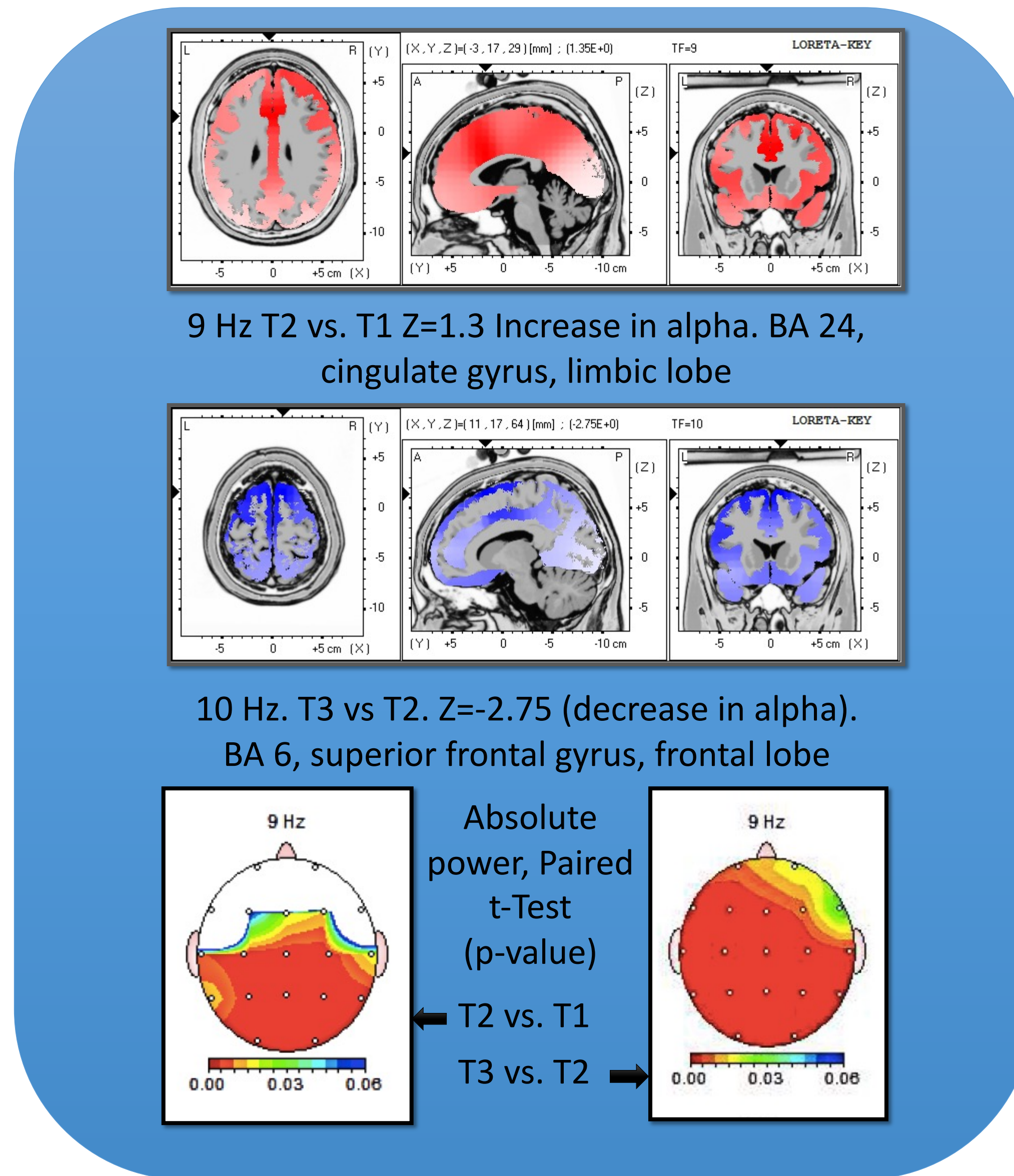
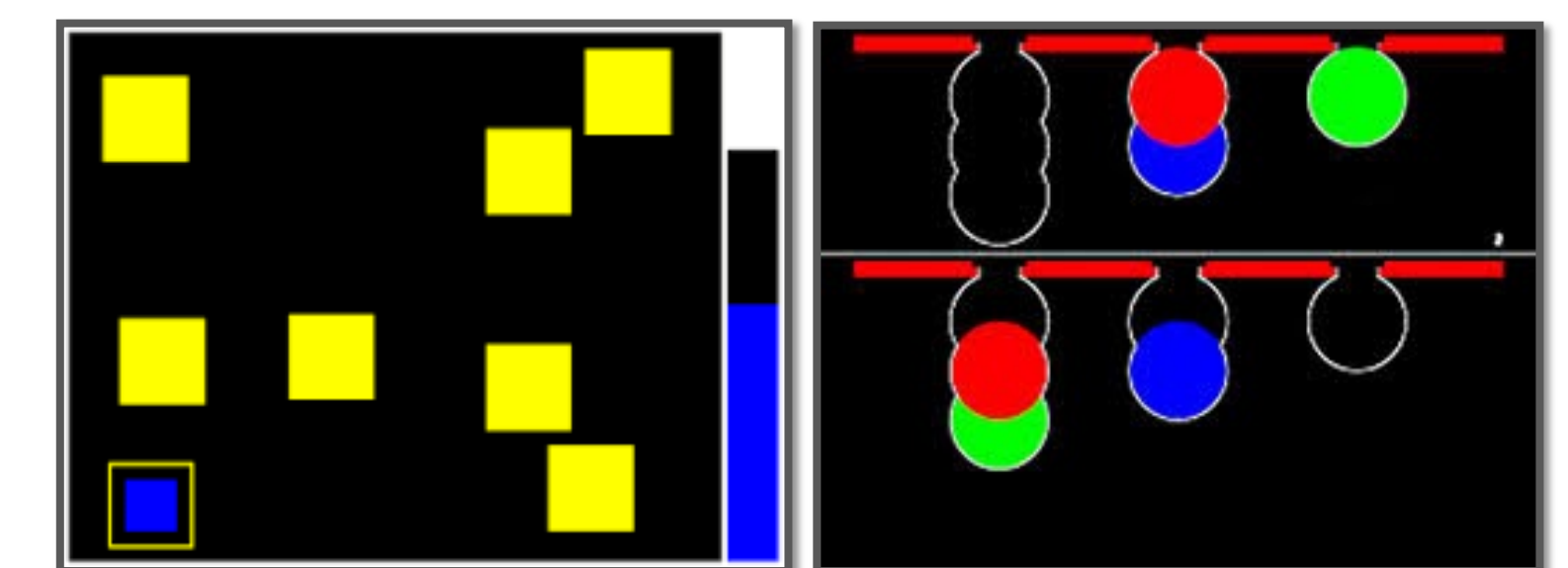
Vision:	Initial	Follow up (1 week)	Follow up (6 week)
Pupillary response	sluggish to light, but hold 10 seconds bilateral	responsive to L, but left slightly sluggish compared to R	Left still sluggish with light
Accommodation	Failure to perform near accommodation	Smooth & symmetric hold for 10s	Able to hold 10sec
VOR	unable to hold gaze w/any head movement in all directions	Intact in all directions and multiple speeds	Intact in all directions and multiple speeds
Saccades	unable to hold gaze at target	Brisk & accurate in all directions	Brisk and accurate all directions
OPK	No response L or downward	Normal	Normal
Tracking	Unable to track	Smooth in all directions	Smooth all directions able to hold accommodation

CAPS	Baseline	1 week	6 weeks
Stable EO	90.6 healthy	93.2 healthy	94.6 (healthy)
Stable EC	88.9 healthy	90.8 healthy	91.6 Healthy
Perturbed EO	82.3 mildly reduced	88.1 healthy	87.2 healthy
Perturbed EC	69.1 moderately reduced	70.7 mildly reduced	63.5 severely reduced

Guerrero RM, Proctor MR, Mannix R, Meehan WP. Epidemiology, trends, assessment and management of sport-related concussion in United States high schools. *Curr Opin Pediatr*. 2012;Dec 24(6):696-701.  
 Morgan CD, Zuckerman SL, Lee YM, King L, Beaird S, Sills AK, et al. Predictors of postconcussion syndrome after sports-related concussion in young athletes: a matched case-control study. *J Neurosurg Pediatr*. 2015; March 6:1-10.  
 Pascual-Marqui RD, Michel CM, Lehmann D. Low resolution electromagnetic tomography: a new method for localizing electrical activity in the brain. *International Journal of Psychophysiology* 1994, 18:49-65.  
 Pascual-Marqui RD. Review of Methods for Solving the EEG Inverse Problem. *International Journal of Bioelectromagnetism* 1999, 1:75-86.

Assessment	Baseline	1 week	6 weeks
Mean simple reaction time	604.8 (0) SD 182.07	292.47 (50-55) SD 36.68	298.8 (50-58) SD 30.9
Five-choice reaction time	581.0 SD 128.35	324.0 SD 33.57	339.00 SD 39.41
AST: Congruency cost (mean, correct)	104.82	53.55	54.62
AST: Switching cost (mean, correct)	243.98	124.13	71.89
AST: mean correct latency (congruent)	675.01	421.71	405.2
PAL: total errors	5 (35-40)	0 (80-85%)	4 (45-50%)
PAL: total errors (6 shapes)	2 (35-40)	0 (50-55)	0 (100)
SWM: standard score: between errors	0.88 (75-80)	1.07 (80-85)	.70 (75-80%)

C3 Logix	Baseline	1 week
Severity symptom index	9	1
BESS	17	9
Trails A	27.1	20.0
Trails B	50.4	30.5
Processing speed (# correct)	66	83
Simple rxn time	288	270
Choice RT	535	363



## Conclusion:

Following one week of chiropractic functional neurology care, a 17-year-old patient with post-concussive syndrome (PCS) experienced rapid recovery of clinical PCS symptoms. Symptom resolution was also noted in measures provided by cognitive assessment instrumentation and qEEG. These results suggest chiropractic functional neurology care may serve as a viable therapeutic intervention for patients suffering PCS.