

Title: Near Point Convergence as a Clinical Predictor of Cognitive Tolerance after a Concussion Injury

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Purpose: The purpose of our study was to identify whether abnormal near point convergence (NPC) could be used as a clinical predictor of cognitive tolerance.

Methods and Study Design: This was a retrospective chart review of 264 encounters with 115 patients ages 10-25 who initially visited a private concussion clinic between 02/21/18 to 02/25/19 for a concussion. NPC was obtained by ultrasound device and confirmed by concussion specialist at every visit. Cognitive tolerance was graded with zones 1-5, based on the fifth consensus, with progressing tolerance towards full time. Zone One is consistent with no school or work due to severe cognitive intolerance, Zone Two is half time or less, Zone Three is half time or more, while Zone Four is full time with accommodations, and Zone Five is full clearance with unrestricted cognitive loads and sports. Patients with learning disabilities and oculomotor deficits were excluded.

Results: Of the patients who met the inclusion criteria, we found a statistically significant difference between the average NPC of the 1 and 5 zones ($p < 0.001$) utilizing a pooled proportions test. Zone 5 had an average NPC of 7.44cm, 8.76cm for 4, 12.75cm for 3, and 14.36cm for Zone 2. This data was represented by a positive linear correlation with an R^2 of 0.96. 77.78% of patients in Zone 5 had a normal NPC (< 9 cm). 94.29% of those with $NPC \geq 13$ cm were greater than half time or less. No patients were reported in Zone One in our patient population due to its severity.

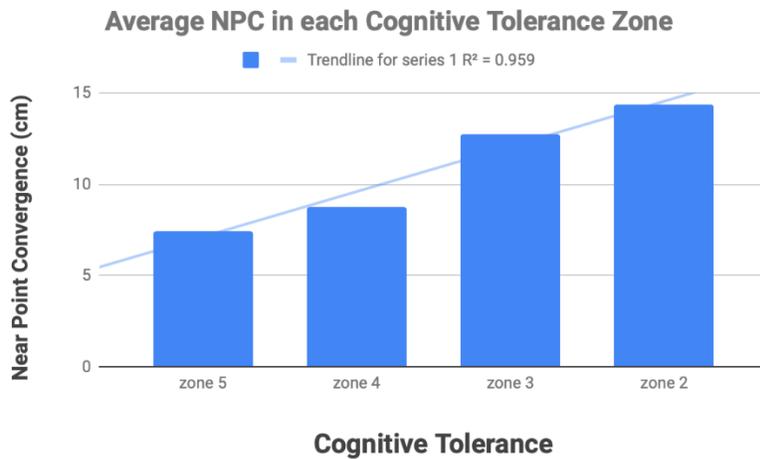
Conclusions: NPC appears to have a strong correlation with cognitive tolerance and can be used as a clinical predictor of return to school or work.

Significance: Little research currently exists on the *clinical* predictors of cognitive tolerance. This data supports the use of *oculomotor testing*, such as NPC, which can easily be completed in clinic, as predictive tools. These zones may signify which patients presenting with concussion require limited cognitive loads and increased accommodations in order to optimize recovery.

Citations:

1. McCrory P, Meeuwisse W, Dvorak J, *et al*
Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016
British Journal of Sports Medicine 2017;51:838-847.

Graph 1:



Graph 2:

