Near Point Convergence and King Devick Test: Predictors of Post Concussion Syndrome?

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Introduction

- The number of concussions diagnosed in the US has almost doubled in recent years, with trends being even more significant in the pediatric population (1).
- The majority of those diagnosed with a concussion recover after a short period. However, 10-20% have persistent symptoms beyond 4-6 weeks and may be diagnosed with post concussion syndrome (2).
- It remains difficult to predict who will develop PCS even with a large number of clinical tools that can be used to measure symptoms and dysfunction.
- Some common tools utilized in clinic or in the field to measure vestibuloocular dysfunction include near point convergence (NPC) and King Devick (KD).

NPC is the distance at which the visual axes intersect under maximum effort of convergence as a target is brought closer to the nose. <6 cm is considered normal, with 6-10 cm considered borderline, and >10 cm considered abnormal.
- KD testing measures the speed of rapid number naming and is a surrogate for impairment of eye movements. There is currently no consensus on what is considered abnormal, although normative data for this test has been collected.

Purpose

The purpose of this study was to identify whether abnormal NPC or longer KD on initial presentation could be used as clinical predictors of PCS.

Hypotheses

- We hypothesized that:
  - A prolonged KD at initial presentation post-concussion would confer higher odds of developing PCS.
  - An abnormal NPC at initial presentation post-concussion would confer higher odds of developing PCS.

Materials and Study Design

- A list of patients who underwent imPACT testing at their first visit at SPARCC sports medicine clinic was used to identify patients who were seen for initial post-concussion evaluation between 1/1/2017 and 12/31/2017 (n=189).
- Patients were included if they met the following criteria:
  - 11-18 years of age
  - Present within 50 days of head injury
  - KD testing and NPC measured at initial visit
  - Followed until cleared to return to play or for at least 40 days
  - Two cohorts: those diagnosed with PCS (n=31) and those without PCS (n=25).
- KD and NPC on presentation for each cohort.
- Odds ratio of developing PCS with a KD ≥ 15 and ≥ 20 seconds.
- Odds ratio of developing PCS with an NPC ≥ 6 cm, ≥ 10 cm, and ≥ 15 cm.

Results

Table 1 displays the average ND and average KD with standard deviation for the non-PCS vs PCS cohort at initial presentation.

Table 2 compares the average NPC and average KD in the non-PCS vs PCS cohorts based on an unpaired T-test yielding P values that illustrate statistical significance.

Conclusions

- Patients who went on to develop PCS had higher average NPC and higher average KD at their initial visit compared to patients who recovered over a quicker timeline.
- A KD ≥ 15 seconds did not confer higher odds of developing PCS, but KD ≥ 20 seconds was associated with significantly higher odds of developing PCS compared with a KD <20 seconds.
- An abnormal NPC was associated with higher odds of developing PCS, with an NPC ≥ 15 cm being associated with the greatest odds.
- A KD ≥ 20 seconds and an NPC ≥ 15 cm at initial presentation post-concussion can be useful tools to identify patients at risk for developing PCS.

Significance

Currently little research exists on clinical oculomotor predictors of PCS. This data supports the use of simple and low cost clinical oculomotor testing such as KD and NPC, as predictive tools that may indicate which patients presenting with concussion will develop PCS.

Acknowledgments

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References


SPARCC
Sports Medicine • Rehabilitation • Concussion Care

Figure 1: Displays average NPC and KD in non-PCS vs PCS cohorts at initial visit

Figure 2: Displays a box and whisker plot of the KD dataset in the non-PCS vs PCS cohort.

Figure 3: Displays a box and whisker plot of the NPC dataset in the non-PCS vs PCS cohort.

Figure 4: Displays the number of patients in PCS vs non-PCS cohorts who had a KD ≥ 20 seconds or <20 seconds at their initial visit post-concussion.

Figure 5: Displays the number of patients in PCS vs non-PCS cohorts who had a NPC ≥ 10 cm or <10 cm at their initial visit post-concussion.

Figure 6: Displays the number of patients in PCS vs non-PCS cohorts who had a NPC ≥ 15 cm or <15 cm at their initial visit post-concussion.