Horizontal Dynamic Visual Acuity Test on C3 Logix Provokes Symptoms in Healthy Collegiate Athletes

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Context: Concussions can impair the vestibular ocular reflex (VOR), which is the ability to focus on an object during head movement. The horizontal dynamic visual acuity test (HDVAT) assesses impairment of the VOR. The C3 Logix iPad application includes an HDVAT for use in baseline-follow-up paradigms to identify VOR deficits post-concussion. However, HDVAT assessment at baseline may elicit concussion-like symptoms in otherwise healthy athletes from stressing the VOR. It is important to understand how healthy athletes respond to HDVAT before assigning clinical importance to post-injury-testing symptom provocation. **Objective:** To determine if the C3 Logix HDVAT provokes symptoms in healthy collegiate athletes. **Design:** Descriptive study. **Setting:** Controlled laboratory. **Patients or Other Participants:** Volunteer sample of 198 healthy NCAA athletes (122 Males; 76 Females; 20.04±1.26 years old; 176.86±10.47cm; 81.31±16.03kg). **Interventions:** Participants provided consent, completed a health history form, and were administered the C3 Logix HDVAT. The HDVAT includes “static” and “dynamic” portions. In the static visual acuity (SVA) portion, participants read and recited letters of decreasing size while looking straight at the iPad with their heads still, similar to visual acuity testing using a Snellen Chart. The dynamic visual acuity (DVA) portion instructed participants to rotate their heads 30° in each direction while reciting the letters. Participants wore an external apparatus to control the extent of head rotation. A metronome cued the pace of motion at one full side-to-side rotation per second. Participants verbally rated symptoms (headache, dizziness, nausea, fogginess) on a 0-10 scale thrice: Baseline, Post-SVA and Post-DVA. A Total Symptom Score (TSS) was calculated by adding the four scores, yielding a 0-40 scale. **Main Outcome Measures:** Dependent variables included item and total symptom scores with differences analyzed with a mixed model ANOVA ($p<.01$ after Bonferroni correction). **Results:** No differences were noted between Baseline (.359±1.378) and Post-SVA TSS (.434±1.522; P=.367) or individual symptom scores (P>.20). Significant differences between Baseline and Post-DVA were identified for TSS (.359±1.378, 95%CI: .092-.625; 1.177±2.424, 95%CI: .910-1.440; P<.001; Cohen’s d=.42), headache (.157±.748, 95%CI: .046-.267; .227±.833, 95%CI: .117-.338; P=.001; Cohen’s d=.09), dizziness (.040±.332, 95%CI: 0.0-.158; .662±1.330, 95%CI: 0.0-.779; P<.001; Cohen’s d=.64), and fogginess (.091±.418, 95%CI: .023-.159; .167±.559, 95%CI: .099-.234; P=.004; Cohen’s d=.15). No difference was found between Baseline and Post-DVA for nausea (.071±.499, 95%CI: 0.0-.153; 121±.680, 95%CI: .039-.204; P=.033). **Conclusions:** While there was a statistically significant increase in symptoms during the HDVAT in healthy collegiate athletes, the small to medium effect sizes make the clinical significance of the change questionable. Clinicians may use the C3 Logix HDVAT as part of a comprehensive management approach to concussion. However, it

may be advisable for clinicians to note when athletes have considerable symptom provocation in response to baseline testing, so they can consider that when evaluating post-concussion follow-up testing. **Word Count: 448**