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Objective Measurement of Lisdexamfetamine's Effects on Reading Patterns in Attention-Deficit Hyperactivity Disorder: A Case Report Utilizing Eye-Tracking Technology

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Abstract

This case report investigates the temporal dynamics of lisdexamfetamine (Vyvanse) in an adult individual with Attention-Deficit Hyperactivity Disorder (ADHD) through novel eye-tracking methodology. Using iFocus, a computer-based tool that quantifies reading patterns based on eye tracking, we tracked medication effects on reading behaviour throughout the day and compared these objective measurements with both the patient's baseline performance and subjective reports. Our findings revealed peak medication efficacy at 6 hours post-administration, with sustained elevated performance for an additional 3 hours. These results diverge from previous literature, which typically reports diminished evening effectiveness [1] and peak plasma concentrations at 4 hours post-administration according to pharmacokinetic studies [2]. This study represents the first application of objective eye-tracking metrics to measure the temporal course of ADHD medication effects, providing a potential new paradigm for monitoring treatment response. The alignment between objective measurements and individual's-reported experiences suggests that eye-tracking technology may offer a valuable complement to existing methods of assessing medication efficacy in ADHD treatment.

Keywords: Lisdexamfetamine; Pharmacokinetic studies; Attention-deficit hyperactivity disorder; Vyvanse; Eye-tracking metrics; Stimulants

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a highly prevalent condition that can affect individuals of all ages [1]. Stimulants are commonly and effectively used to treat ADHD, and among them long-acting stimulants are becoming more common as they enable the individual to function throughout the day [2].

Pharmacokinetics indicates the concentration of d-amphetamine is highest about 4-6 hours after taking lisdexamfetamine [3] and clinical trials show effect reported as decreasing in the evening [4]. While this is valuable information for treatment guidance, a reliable biomarker will enable individualized analysis of the response to long-acting stimulants [5]. This report highlights objective measures, performed several times through the day, and indicates that lisdexamfetamine can be effective in different ways for different individuals.

Medication Effect Assessment

An iFocus session includes reading 300-word text from a home computer, with a webcam. The texts are different middle school level non-fiction paragraphs. iFocus measure requires at least 4 baseline sessions done without medication. The baseline sessions can be done on a single or separate days. Scores were calculated per session using the iFocus algorithm, described previously [6].

Case Description

A 49-year-old woman, diagnosed with combined ADHD ~20 years ago, and was treated with stimulant medication since. For the past 2 years she is treated with Vyvanse 60mg, and no additional regular medication. She finds her medication most effective in the late afternoon.

The individuals base line sessions were done on two different days, before taking medication later in the same day. After medication was taken, sessions were performed at different time points along the day. There was a total of 19 measurements, taken over 5 days (Figure 1).

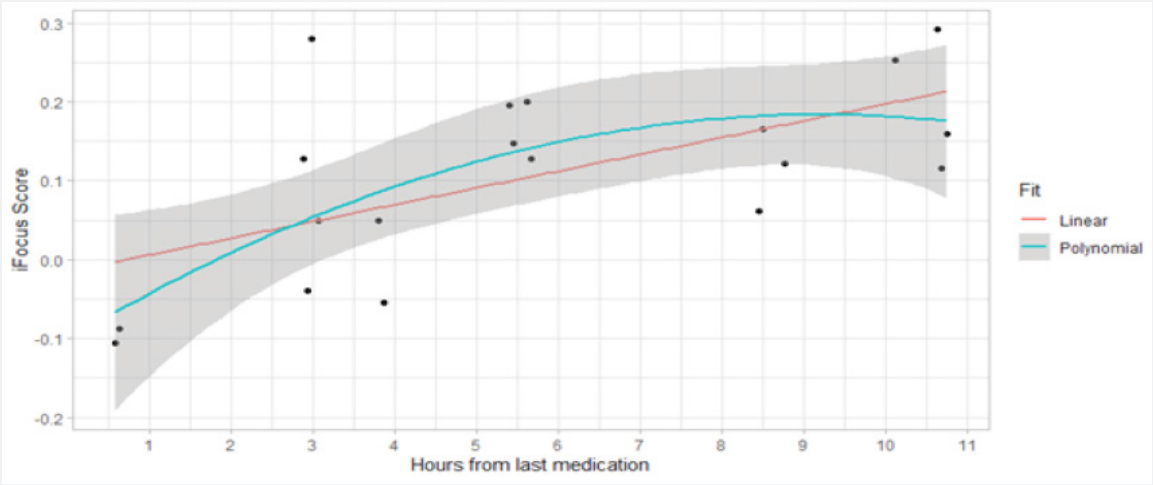

Figure 1: Scores plotted as a function of hours since last medication taking. A linear line is fitted, shown in red, a second degree polynomial is fitted in cyan, gray shade represents the standard error of the second degree polynomial.

Conclusion

This case study demonstrates a sustained increase in medication efficacy throughout the day, as measured by objective eye-tracking metrics. While these findings provide novel complementary data to existing clinical trial evidence, further investigation with a larger cohort is warranted. Future studies should examine diverse patient populations and multiple ADHD medication classes to establish whether this extended duration of effect represents a common pattern among long-acting stimulant medications.

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